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ALYTES

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Alytes, 1997, **14** (4): 129.

Editorial: 15 years of *Alytes*

Founded in February 1982, *Alytes* is now reaching the term of its fifteenth year of existence. Started as a modest national bulletin, its printing standard and the quality of its contents have been regularly increasing over the years. The journal has now published a number of interesting and important papers and is now recognized worldwide as a major scientific periodical dealing with all aspects of the study of amphibians. This is also testified by the growing mean quality of manuscripts submitted for publication in the journal over the years.

The experience accumulated by the editorial team of the journal over this fifteen-year period has allowed us to make important progress in several respects, and, in particular, regarding the standards of preparation and processing of manuscripts necessary to obtain a high quality journal. We think it is useful to share this experience with our readers and with potential authors of papers intended for publication in *Alytes*. For this reason, we present in this issue very detailed *Instructions to Authors*, which will hopefully prove useful to colleagues to prepare high quality manuscripts and will contribute to a further increase in the standards of the journal.

We feel that the experience of these first fifteen years has amply demonstrated that an international journal of batrachology was really needed. Gathering together of papers once dispersed in various journals, written in three major languages, and concerning very diverse aspects of the study of a relatively poorly known group of vertebrates, has proved extremely stimulating, and will no doubt become more and more productive as time goes on. The recent international interest in the problems of conservation of amphibian populations and species has also clearly emphasized the need for a particular effort of the international community, not only to understand the causes of the observed declines and to try and stop or reduce them, but also to increase and speed up our efforts for the mere work of inventory and description of amphibian species on our planet: it is now clear that, if we delay considering this task as a major priority for amphibian specialists of our time, many amphibian taxa will become extinct in the forthcoming years, without their having even been collected and recognized by man. This is well exemplified in this issue of *Alytes*, which contains the descriptions of several new species, all of which are clearly threatened with extinction, and some of which may even be already extinct as these descriptions are published. It is rather unusual to publish a paper dealing with the contemporaneous fauna that describes four new species but at the same time states that they were probably "already" extinct when these descriptions were written. Unfortunately, it is very likely that in the coming future we will have to confront such situations more and more often, as a consequence of ongoing massive destructions or extensive modifications of amphibians' habitats throughout the world. It results from this that basic alpha taxonomic work of inventory and description of amphibian species is an urgent matter that should deserve all our attention, including the creation of academic positions and financial support for field work, collection management and descriptive activity. All well considered, this might be much more urgent than concentrating all efforts on more "theoretical" issues of biology, however interesting and important the latter may be. Understanding of these priorities is the reason for the clear choice made in *Alytes* to encourage publication of "purely descriptive" papers of high quality, which has been characteristic of the journal since its beginnings and which will continue to be so in the years to come.

Alain DUBOIS
Alytes Chief Editor
19 December 1996

Bibliothèque Centrale Muséum

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Source : MNHN, Paris

Alytes, 1997, **14** (4): 130-146.

Description of two new frogs of the genus *Mantidactylus* from Madagascar, with notes on *Mantidactylus klemmeri* (Guibé, 1974) and *Mantidactylus webbi* (Grandison, 1953) (Amphibia, Ranidae, Mantellinae)

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Two new species of the endemic Malagasy frog genus *Mantidactylus* were discovered during recent fieldwork in northeastern Madagascar, and these are formally named and described in this paper. The first one inhabits mossy stone habitats in the Marojezy massif and is mainly characterized by its olive-greenish coloration and a short snout. The second new species is similar but larger and has a copper red iris. It is characterized by a very distinctly protruding inner metatarsal tubercle which is less developed in other known *Mantidactylus*. Both new species are tentatively included in the subgenus *Gephyromantis*, but their relationships with other *Mantidactylus* remain obscure. Morphologically they are most similar to *M. klemmeri* and *M. webbi*; we therefore provide an updated diagnosis of these two species and a detailed description of the call of *M. klemmeri*, as well as first data on its ecology and coloration in life.

INTRODUCTION

The systematics of the frog genus *Mantidactylus* Boulenger, 1895, endemic to Madagascar, has been the subject of several studies during the last 20 years. The biosystematic investigations of BLOMMERS-SCHLÖSSER (1979) showed that the distinction between the genera *Gephyromantis* and *Mantidactylus*, as made by GUIBÉ (1978) and previous workers, was largely artificial. As a conclusion, BLOMMERS-SCHLÖSSER (1979) considered *Gephyromantis* as a junior synonym of *Mantidactylus*. She also described two new species of the genus and assigned 31 *Mantidactylus* species to 10 phenetic species groups. BLOMMERS-SCHLÖSSER & BLANC (1991) assigned all *Mantidactylus* species to these groups and analysed phylogenetic relationships within *Mantidactylus*. The cladogram presented by these authors characterized the species groups by assumed synapomorphies,

Source : MNHN, Paris

and thus suggested that each represents a monophyletic unit. DUBOIS (1992) elevated some of these groups to subgeneric rank. Based on new biosystematic data, GLAW & VENCES (1994) argued that the monophyly of the subgenera within *Mantidactylus* would be more convincing recognizing four additional subgenera. They also noted that no phylogenetic arguments remain to regard *Laurentomantis* Dubois, 1980 as a genus separate of *Mantidactylus*, and thus considered it as a subgenus, transferring the three *Laurentomantis* species to *Mantidactylus*. Following GLAW & VENCES (1994), 12 subgenera within *Mantidactylus* are presently accepted: *Mantidactylus* Boulenger, 1895; *Gephyromantis* Methuen, 1920; *Hylobatrachus* Laurent, 1943; *Laurentomantis* Dubois, 1980; *Blommersia* Dubois, 1992; *Brygoomantis* Dubois, 1992; *Guibemantis* Dubois, 1992; *Spinomantis* Dubois, 1992; *Chonomantis* Glaw & Vences, 1994; *Ochthomantis* Glaw & Vences, 1994; *Pandanusicola* Glaw & Vences, 1994; *Phylacomantis* Glaw & Vences 1994.

Since 1990, eight new *Mantidactylus* species have been described (BLOMMERS-SCHLÖSSER & BLANC, 1991; GLAW & VENCES, 1992*b*, 1994), one species was transferred to this genus from the genus *Boophis* (GLAW & VENCES, 1992*a*) and three species were resurrected from synonymy (BLOMMERS-SCHLÖSSER & BLANC, 1991; RAXWORTHY & NUSSBAUM, 1994; ANDREONE & GAVETTI, 1994). Despite this intensive work on the genus, the species inventory of *Mantidactylus* is far from being complete. The continued discovery of new species even in well studied areas shows that the genus is much more speciose than presently recognized (59 named species according to GLAW & VENCES, 1994).

The subgenus *Gephyromantis* currently contains 10 species which are arranged in two species groups according to GLAW & VENCES (1994): the *M. asper* group with four scansorial primary forest species, which can be found during the day on the forest floor and which call predominantly at night from leaves and branches; and the *M. boulengeri* group with six rather small ground-dwelling frogs which call mainly during the day. Probably closely related subgenera are *Laurentomantis* with three species and *Phylacomantis* with six species. The monophyly of these taxonomic units (subgenera and species groups) must still be verified since the attribution of species to subgenera within *Mantidactylus* is often only based on phenetic similarity, the diagnostic synapomorphies of the groups generally being derived from studies of only a few species.

Two species of the subgenus *Gephyromantis* differ from other species of this subgenus mainly in terms of their coloration which is partly greenish, and their ecology which is associated with mossy rocks along forest brooks. These species are *M. webbi*, and one species which up to now was regarded as *M. klemmeri* (GLAW & VENCES, 1994).

Fieldwork conducted during 1994 and 1995 yielded new data on these two forms, and resulted in the discovery of two additional species which are morphologically similar to *M. webbi* and to the species previously regarded as *M. klemmeri*. After examination of the types of *Mantidactylus klemmeri* and *M. webbi* in the context of the two similar, newly discovered species, we conclude that the four forms studied by us are *M. klemmeri*, *M. webbi*, and two unnamed forms which we will here describe as new species.

Source : MNHN, Paris

Material and methods

Specimens were captured by hand both during the day and at night with the aid of flashlights. They were fixed for a few minutes in 96 % ethyle alcohol, and stored in 70 % ethyle alcohol. Live animals were photographed to document color and pattern variation. Morphometric measurements were taken by the first author with a ruler to the nearest 0.5 mm or with a precision calliper to the nearest 0.1 mm. Abbreviations used are SVL (snout-vent length) and HW (head width). Tympanum and eye diameter were measured along a horizontal plane.

Calls of *M. klemmeri* were recorded with a Tensai portable tape recorder and an external VIVANCO EM 238 microphone. These were analysed with the sound analyzing system "MEDAV Spektro 3.2".

Type material was examined both in the Natural History Museum, London, United Kingdom (BM) and the Muséum National d'Histoire Naturelle, Paris, France (MNHN). Other abbreviations used in this paper are as follow: MRSN, Museo Regionale di Scienze Naturali, Torino, Italy; ZFMK, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, Germany.

Results

The identity of *Mantidactylus klemmeri*

In 1994, Glaw & Vences (color plate 101) showed a picture of a brook-dwelling frog from the Marojezy mountains which they considered to be *Mantidactylus klemmeri*. The pictured species occurred along brooks near the *M. klemmeri* type locality and was morphologically similar to that species. Furthermore, its unique character combination separated it clearly from any other described *Mantidactylus*. In 1995, however, F. Glaw collected a second frog species in Marojezy which inhabited the forest floor and showed some important morphological and ecological differences from the species previously assigned to *M. klemmeri*. These differences are summarized in tab. 2, whereas tab. 1 shows the absolute measurements of all specimens considered in the present publication. A direct comparison with the types of *Mantidactylus klemmeri* showed that the species inhabiting the forest-floor should be assigned to this taxon. An updated diagnosis of *M. klemmeri* together with first data on its advertisement call is presented below. The brook-dwelling form is consequently described as a new species.

Source : MNHN, Paris

Tab. 1. - Measurements (all in mm) of the *Mantidactylus* specimens considered in the present study. Number: abbreviation of museum where specimen is held, and its collection number. Holotypes are marked with a * behind the number, paratypes with a + behind the number. Other abbreviations used are: M, male; F, female; J, juvenile; SVL, snout-vent length; HW, head width; Eye, horizontal eye diameter; Tym, horizontal tympanum diameter; E-N, distance between anterior eye margin and nostril; N-ST, distance between nostril and snout tip; HL, hand length; FLiT, foot length including tarsus; TibT, tibiotarsal articulation reaching (1) eye, (2) beyond eye, (3) nostrils, (4) snout tip, (5) slightly beyond snout tip, (6) clearly beyond snout tip; ToeL, relative length of third toe compared with fifth toe; FGS, size of femoral glands, given as length × width; FGD, distance between inner margins of glands on opposite femurs. All specimens are from the type localities of the respective species, except for MNHN 1975.781 (*M. klemmeri*; female from the Chaînes Anosyennes) and MNHN 1975.951-952 (male and female of *M. webbi* from Andohahela).

Species and number	Sex	SVL	HW	Eye	Tym	E-N	N-ST	HL	FLiT	TibT	ToeL	FGS	FGD
Mantidactylus klemmeri													
MNHN 1973.960+	M	20.8	7.3	3.0	1.2	2.0	1.2	6.9	16.5	(5)	3=5	1.5×1.5	2.7
MNHN 1973.959+	M	20.8	7.2	2.6	1.1	2.3	1.5	6.2	17.1	–	3=5	1.7×1.4	2.6
MNHN 1973.957+	M	20.0	6.9	3.0	0.9	2.2	1.3	6.6	17.5	(4)	3=5	1.9×1.2	2.4
MNHN 1973.958+	M	21.2	6.6	2.8	0.9	2.2	1.3	6.5	16.0	(5)	3=5	-	-
ZFMK 59944	M	20.5	7.0	2.7	0.9	2.2	1.5	7.0	16.2	(6)	3=5	2.0×1.4	1.5
ZFMK 59943	M	19.5	6.5	2.5	0.9	2.2	1.5	6.2	15.6	(5)	3=5	2.4×1.7	2.2
ZFMK 59942	M	20.5	6.6	2.5	1.0	2.2	1.5	6.4	17.3	(5)	3=5	1.8×1.3	2.7
MNHN 1973.962+	F	20.8	6.5	2.7	0.9	2.2	1.2	6.5	17.2	(5)	3≤5		
MNHN 1973.961+	F	24.0	7.3	3.3	1.2	2.5	1.5	7.7	18.4	(4)	3=5		
MNHN 1973.956+	F	24.0	7.2	3.1	1.0	2.5	1.4	7.0	18.5	-	3=5		
MNHN 1973.955*	F	24.0	7.5	2.8	1.1	2.6	1.4	8.0	18.9	(5)	3=5		
MNHN 1973.963+	J	16.8	-	-	-	-	-	-	-	-	-		
MNHN 1975.781	F	26	8	3.2	1.4	2.5	2.2	8.2	-	(4)	3=5		
Mantidactylus rivicola													
ZFMK 57428*	M	22.5	7.5	2.6	1.0	2.0	1.4	7.8	16.7	(4)	3≤5	1.5×1.3	0.8
ZFMK 59898+	M	24.3	8.8	3.4	1.7	2.5	1.7	8.0	18.0	(5)	3=5		
ZFMK 57429+	F	23.8	7.8	3.2	1.2	2.0	1.6	7.5	16.3	(2)	3=5		
ZFMK 59946+	F	24.3	7.7	2.9	1.4	1.9	1.4	7.0	16.5	(4)	-		
ZFMK 59945+	F	24.2	7.5	3.0	1.1	1.9	1.5	7.1	15.5	(2)	3=5		
ZFMK 59947+	J	19.4	5.9	2.5	0.9	1.6	1.1	5.6	14.4	(5)	3=5		
Mantidactylus silvanus													
MRSN A1661*	M	30.5	10.5	3.9	2.2	2.9	2.0	9.5	21.0	(3)	3≤5	2.2×1.5	ca. 1.0
Mantidactylus webbi													
MNHN 1975.951	M	22.5	8.0	2.2	1.0	2.3	1.4	7.3	16.0	(3)	3=5	3.7×2.0	1.0
MNHN 1975.952	F	24.9	8.5	2.9	1.3	2.4	1.8	8.8	20.0	(6)	3=5		
ZFMK 52725	M	24.9	8.7	3.0	1.8	2.5	1.5	7.8	19.0	(5)	3=5	3.6×1.5	2.3
ZFMK 52726	F	30.5	10.5	2.7	1.6	3.5	1.7	9.8	22.2	(4)	3=5		

Source : MNHN, Paris

Tab. 2. - Comparison between the four *Mantidactylus* species treated in the present study. Morphometric data from tab. 1. IMT: inner metatarsal tubercle. Other abbreviations as in tab. 1. Values are given as range; mean ± standard deviation is given in brackets. Significant differences (Mann-Whitney *U* test) were detected between value pairs marked with stars (* $P < 0.05$; ** $P < 0.005$). Values for snout-vent length are given separately for males (M) and females (F). For snout-vent length only specimens from the type localities were considered; other values are based on all specimens listed in tab. 1.

	M. klemmeri	*M. rivicola*	*M. silvanus*	*M. webbi*
SVL (M) [mm]	19.5 - 21.2	22.5 - 24.3	30.5	24.9
SVL (F) [mm]	20.8 - 24.0	23.8 - 24.3	—	30.5
HW:SVL	0.30 - 0.35 (0.32±0.02)	0.30 - 0.36 (0.33±0.02)	0.34	0.34 - 0.36 (0.35±0.01)
HL:SVL	0.29 - 0.34 (0.32±0.02)	0.29 - 0.35 (0.31±0.02)	0.31	0.31 - 0.35 (0.33±0.02)
FLiT:SVL	0.40 - 0.88 (0.77±0.12)	0.64 - 0.74 (0.71±0.04)	0.69	0.71 - 0.80 (0.75±0.04)
Tym:Eye	**0.30 - 0.44 (0.37±0.05)	0.36 - 0.50 (0.41±0.06)	0.56	**0.45 - 0.60 (0.52±0.08)
(Eye-N + N-ST):SVL	*0.14 - 0.19 (0.17±0.01)	*0.14 - 0.17 (0.15±0.01)	0.16	0.16 - 0.17 (0.17±0.004)
Eye-N : N-ST	**0.48 - 0.68 (0.60±0.07)	**0.68 - 0.80 (0.73±0.05)	0.69	0.49 - 0.75 (0.61±0.1)
General habitat	forest floor	forest brooks	forest brooks?	forest brooks
Micro-habitat	on leaf litter/roots	on mossy rocks	at night on leaves	on mossy rocks
Habitus	very slender	slender	less slender	less slender
Dorsal skin	finely granular	some large granules	finely granular	coarsely granular
Snout	long, pointed	short	long	long
IMT	small	protruding	strongly protruding	reduced
Color	brownish	olive greenish	olive greenish/brown	olive greenish

Tab. 3. - Parameters of six notes from calls of *Mantidactylus klemmeri*, recorded in the Marojezy Strict Nature Reserve. Notes 1-3 from Camp 3 (26.02.1995; air temperature 23.8°C), notes 4-6 from Camp 4 (28.02.1995; air temperature 22.5°C). All temporal measurements are given in milliseconds (ms).

	1	2	3	4	5	6
Note duration	648	662	769	731	718	626
Number of primary pulses	4	4	4	1	2	1
Duration of primary pulses (range)	17 - 22	16 - 26	20 - 25	-	-	-
Duration of primary pulses (mean)	19.5	20.5	21.5	-	-	-
Interval between primary pulses (range)	24 - 43	25 - 41	19 - 36	-	-	-
Interval between primary pulses (mean)	32	31	28.3	-	-	-
Number of double clicks	1	1	2	0	0	0
Duration of double clicks	20	17	18 - 20	-	-	-
Duration of secondary pulse series	406	419	507	684	575	534
Number of secondary pulses	23	25	31	18	17	17
Repetition rate of secondary pulses	56.7	59.7	61.1	26.3	29.6	31.8

Source : MNHN, Paris

Mantidactylus klemmeri (Guibé, 1974)

Gephyromantis klemmeri Guibé, 1974; GUIBÉ, 1978.
Mantidactylus klemmeri: BLOMMERS-SCHLÖSSER & BLANC, 1991; GLAW & VENCES, 1992*b*, 1994 (partim).
Mantidactylus (Gephyromantis) klemmeri: DUBOIS, 1992.

Diagnosis. – A small, extremely slender, brownish frog, belonging to the genus *Mantidactylus* as is evident from the presence of femoral glands in males (not recognizable in females). The absence of webbing between the toes, in combination with the small size, connected lateral metatarsalia, and the presence of a subgular vocal sac (laterally blackish) in males allow a distinction to be made from most other *Mantidactylus*. *M. eiselti* and *M. thelenae* are morphologically very similar but their advertisement calls differ distinctly. *M. webbi* and the two new species described below have a different coloration (partly greenish). Additionally, *M. webbi* males can be recognized by the white vocal sac, and the two new species have distinct, protruding inner metatarsal tubercles (small and not protruding in *M. klemmeri*).

The tibiotarsal articulation of *M. klemmeri* reaches at least the tip of snout or beyond as was noted by GUIBÉ (1974) in the original description, not between nostrils and tip of snout as was first stated by BLOMMERS-SCHLÖSSER & BLANC (1991) and subsequently quoted by GLAW & VENCES (1992*b*, 1994).

Type material. – Holotype MNHN 1973.955, adult female, and paratypes MNHN 1973.956-963, four adult males, three adult females and one juvenile specimen, all collected by C.-P. BLANC in December 1972 in the "Massif du Marojezy" at an altitude of 600 m. Measurements of the types and of three additional ZFMK specimens from the type locality are given in tab. 1.

Color in life. – Based on color slides of ZFMK specimens, the dorsum and flanks are marbled grey or brownish without distinct transversal markings. No specimens with a light median dorsal stripe were found at Marojezy. Indistinct dark crossbands are present on fore- and hindlegs. The lower lip is dark with some rather regularly spaced light spots. Sometimes this pattern also occurs on the upper lip, resulting in transverse dark and light bands. In other specimens a light frenal stripe is faintly recognizable. The tympanic area is brown. This brown patch runs from the eye to the insertion of forelegs. The thorax and throat are marbled brown and white, the marbling on the venter and ventral limb surfaces being lighter and less contrasting. A light median line is sometimes present on the throat. Males have a distinct subgular vocal sac which is laterally blackish, indicating a possible paired or bilobate shape of the inflated sac.

Distribution. – Apart from the type material and our specimens, which were all collected in the Marojezy Strict Nature Reserve (Réserve Naturelle Intégrale) in northeastern Madagascar, one additional specimen from the Anosy mountains ("Chaînes Anosyennes") in southeastern Madagascar is available in the MNHN. This female (MNHN 1975.781) is somewhat larger than the other specimens and has a light median dorsal stripe, but shows no other morphological differences (tab. 1) from the types. We therefore consider it as belonging to the species *M. klemmeri* pending the obtention of more data.

Source : MNHN, Paris

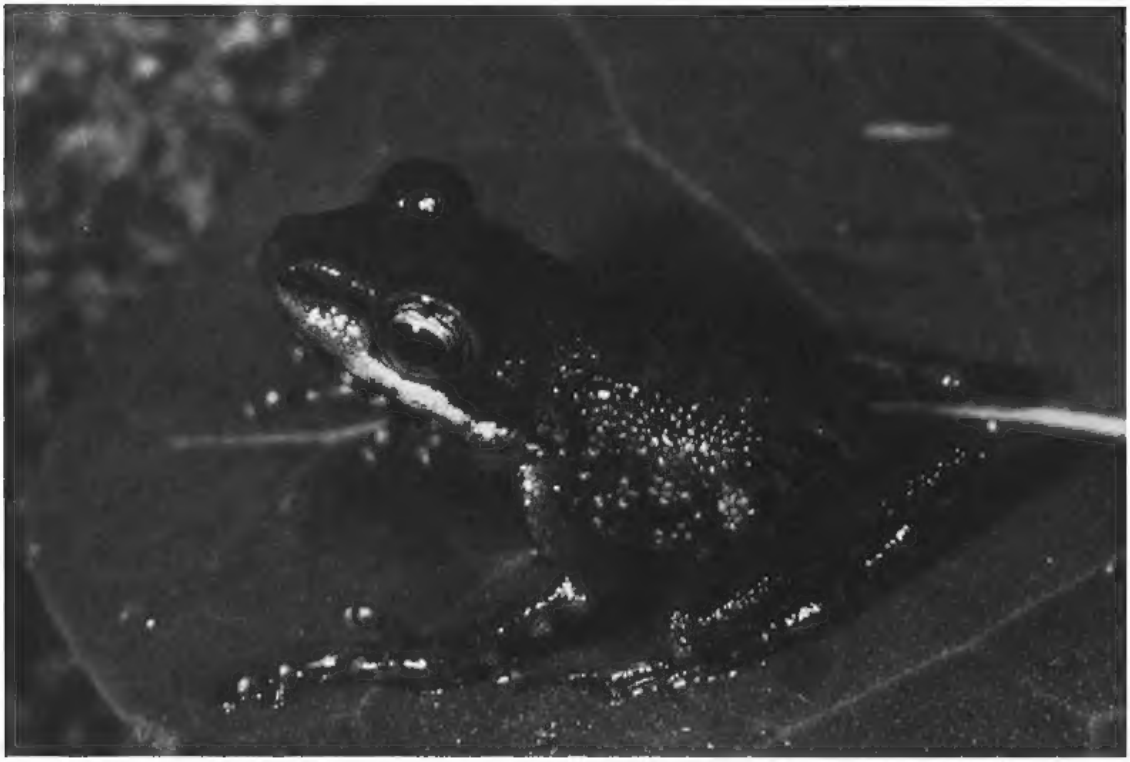

Fig. 1. – Specimen of *Mantidactylus klemmeri* from Marojezy Strict Nature Reserve, Camp 3, 26.02.1995.

Habitat and habits. – Specimens were found in 1995 at Marojezy between 600 and 1300 m elevation (up to above Camp 4). Males call during the day from the ground, mostly from between tree roots where specimens hide when disturbed. Calling males occur in small groups clustered in certain areas, but do not form dense choruses. They are not confined to the vicinity of water bodies. No activity was observed at night.

Call. – The calls were recorded on 26.02.1995 and 28.02.1995 in the Marojezy reserve (near Camp 3, about 700 m elevation, at 23.8°C, and at Camp 4, 1250 m, at 22.5°C). The first locality is very near to the type locality of *M. klemmeri*: "Massif du Marojezy (600 m)" (Guibé, 1974: 1175).

As in some other members of the *M. boulengeri* group (*M. boulengeri*, *M. decaryi*, *M. eiselti*, *M. thelenae*), the general structure of a call can be described as a series of notes. In *M. klemmeri* a call consists of up to 6 notes. Note duration ranges from 626 to 982 ms; the duration of intervals between two notes of a series is about 2 s (measured minimum 1709 ms).

The general structure of a note is often quite complex and can be described as a series of 1-5 primary pulses, followed by 0-2 double-clicks, followed by a series of 17-31 secondary pulses. The pulse repetition rate of the secondary pulses is 56.7-61.1/s at a temperature of 23.8°C (recorded at Camp 3). The notes recorded at higher altitude (Camp 4) had a much lower pulse repetition rate (26.3-33.9/s) which may only partly be explained

Source : MNHN, Paris

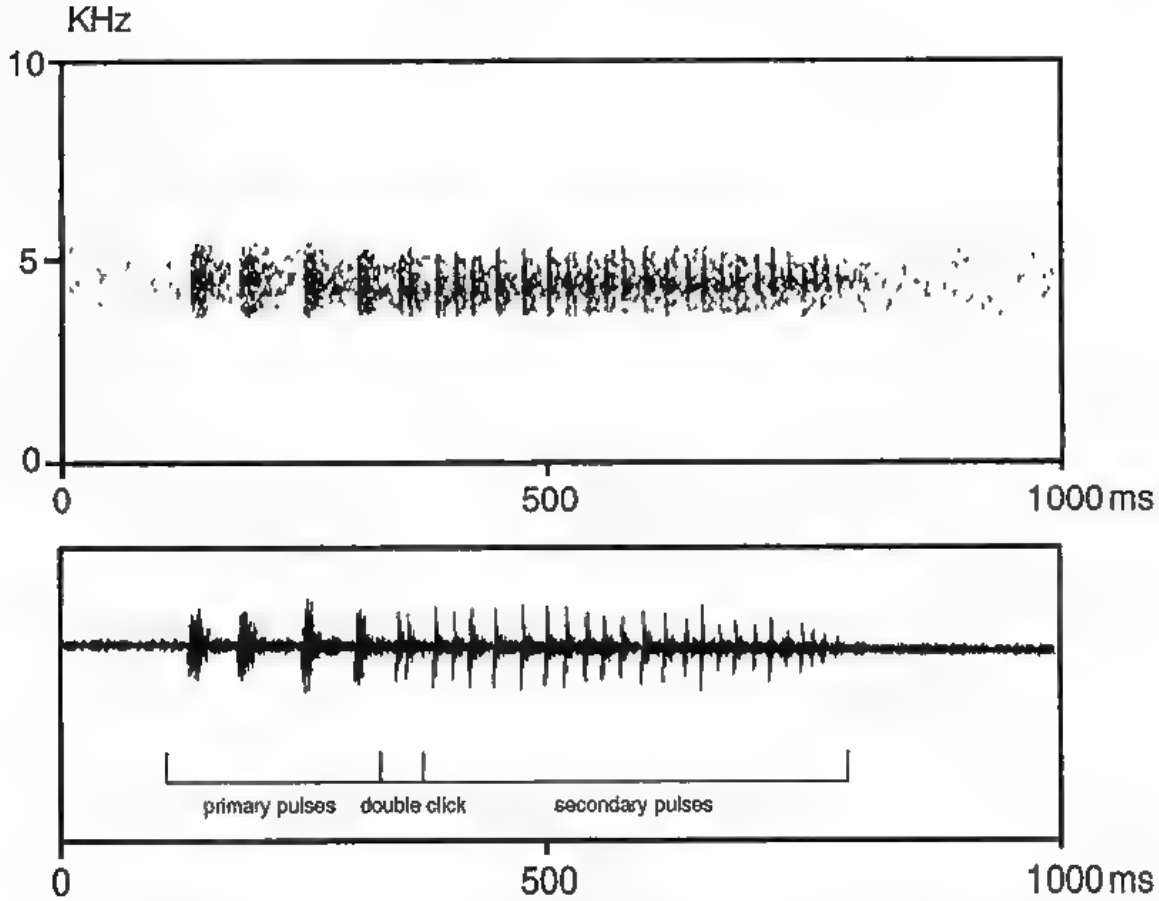

Fig. 2. – Sonagram and oscillogram of the call of *Mantidactylus klemmeri*, recorded in the Marojezy Strict Nature Reserve, Camp 3, on 26.02.1995 (air temperature 23.8°C)

by the slightly lower temperature (22.5°C). The frequency of all call components range from 3700 to 5100 Hz. Detailed data of six notes are summarized in tab. 3.

The structure of the call of *M. klemmeri* is similar to that of *Mantidactylus thelenae* However, the call of the latter species is characterized by a shorter note duration (540-650 ms) and shorter intervals between notes (1140-1480 ms). A striking difference is the much higher pulse repetition rate (about 250/s) in the call of *M. thelenae*.

Subgeneric attribution. – As indicated by its morphology (subgular vocal sac laterally blackish, connected lateral metatarsalia, femoral glands present only in males) and especially natural history (calling not concentrated around water, therefore probably direct development), this species belongs to the subgenus *Gephyromantis*, *M. boulengeri* group. It is probably closely related to *M. eiselti* and *M. thelenae*.

Source MNHN, Paris

Mantidactylus rivicola sp. nov.

Diagnosis. – A rather small olive-greenish frog belonging to the genus *Mantidactylus* as is evident from the presence of femoral glands in the males (absent in females). The character combination of small size, connected lateral metatarsalia, scarcely webbed feet, and presence of a protruding inner metatarsal tubercle is diagnostic for this species. Other riparian *Mantidactylus* with partly greenish dorsal coloration are *Mantidactylus lugubris* (subgenus *Hylobatrachus*) and young *Mantidactylus microtympanum* (subgenus *Mantidactylus*) which have strongly webbed feet and separated lateral metatarsalia, and *M. webbi* which has only rudimentary metatarsal tubercles and a laterally white vocal sac. Members of the subgenus *Laurentomantis* generally have a coarse granular skin and a very broad head; however, the species *Mantidactylus* cf. *malagasius* which occurs sympatrically with *M. rivicola* is morphologically rather similar to the latter. It can be distinguished by the more granular skin, different coloration (not greenish), absence of recognizable vocal sac in males, and slightly longer hindlimbs (tibiotarsal articulations reaching distinctly beyond snout tip).

M. rivicola is most similar to the second new species described below: for distinctive characters see the diagnosis of that species.

Derivatio nominis. – From the Latin *rivus* (brook) and *colere* (to inhabit). This species typically is an inhabitant of brook edges.

Holotype. – ZFMK 57428, adult male, from near Camp 1, Marojezy Strict Nature Reserve (Réserve Naturelle Intégrale), northeastern Madagascar, altitude about 300 m above sea level, collected by F. Glaw, N. Rabibisoa and O. Ramilison on 27.03.1994.

Paratypes. – ZFMK 57429, adult female, same collection data as the holotype, ZFMK 59945-59946, two adult females, ZFMK 59898, adult male, and ZFMK 59947, juvenile, from same locality as holotype, collected by F. Glaw and O. Ramilison from 25 to 28.02.1995.

Description of the holotype. – See tab. 1 for measurements. Body slender. Widest part of head slightly wider than widest part of body. Dorsal outline of head triangular, snout rather short. Snout protruding over upper jaw in lateral view. Nostrils not distinctly protruding, with lateral openings. Loreal region slightly concave. Tympanum distinct, rather small, slightly larger than 1/3 of eye diameter. Distinct supratympanic fold above the tympanum, which does not distinctly continue posterior to the tympanum. Forelegs and hindlegs slender. Outer metacarpal tubercle present. Finger discs enlarged, semicircular. No webbing between fingers. Comparative finger length $1 < 2 < 4 < 3$. Toe discs slightly enlarged, smaller than finger discs. Traces of webbing between toes. Comparative toe length $1 < 2 < 3 \leq 5 < 4$. Inner metatarsal tubercle rather large (length about 1 mm), protruding forewards. Lateral metatarsalia largely connected. Dorsal skin rough, with longitudinal tubercles in two rows bordering the median line. Some larger tubercles on the flanks. Small, oblique femoral glands with rather indistinct borders. Vomerine teeth rudimentary, hardly recognizable. Subgular vocal sac structure distinctly recognizable. Greyish lateral color on the sac surface possibly indicates that the (subgular) vocal sac may have a paired or bilobate shape when inflated

Source MNHN, Paris

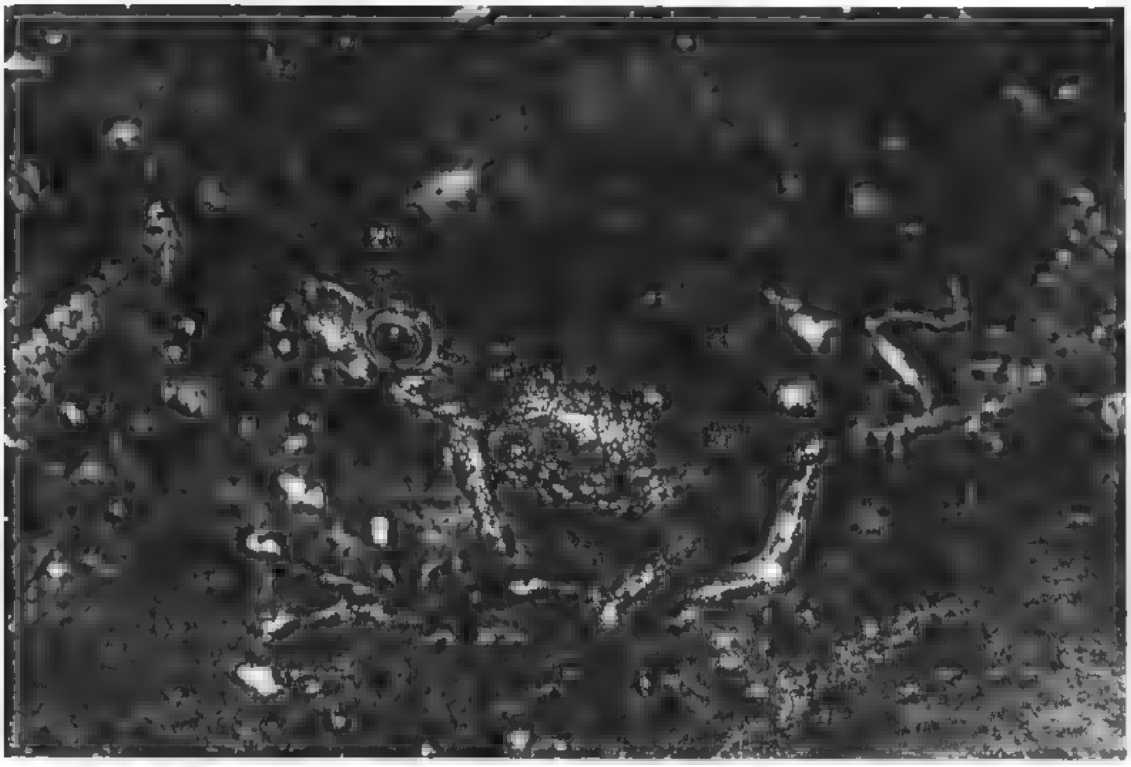

Fig. 3. – Paratype of *Mantidactylus rivicola*, ZFMK 57429, from Marojezy Strict Nature Reserve, Camp 1, 27.03.1994.

Coloration of the holotype. – After 1.5 year in alcohol, the head, dorsum and flanks are mossy olive greenish with two indistinct dark transversal markings. A light median line runs from tip of snout to the anus. In the middle of the dorsum to the left and the right of this line there are very thin dark and discontinuous folds; on the anterior dorsum these folds run laterally towards the eyes. Fore- and hindlimbs as well as hands and feet have distinct dark crossbands. The tips of the fingers are white. The eyes are completely white. The lower lip is dark, broken by some alternating light spots, which do slightly correspond to the markings on the upper lip The tympanum is brownish and lighter than the skin surrounding it. There is no distinct brown spot from the eye through the tympanum to the insertion of the foreleg and no light stripe along the upper lip. Throat and venter are grey with no distinct spots. A distinct white stripe extends from the tip of snout to the thorax. In the thorax area this stripe is surrounded by brown. The ventral surface of the limbs is greyish.

Description of paratypes. – Morphological features of the paratypes are consistent with those of the holotype. See tab. 1 for measurements. The supratympanic folds are quite irregular, often nearly unrecognizable behind the tympanum or fusing with large lateral tubercles. Coloration of the paratypes is similar to that of the holotype. A median dorsal stripe is absent in all paratypes except ZFMK 59947. The dark transverse markings on the

Source MNHN, Paris

dorsum are more distinct in ZFMK 57429 and 59945, the dark bands on hands and feet are very distinct in ZFMK 59898. The latter specimen also has some white tubercles on the flanks which are less distinct in the other specimens. The light stripe on throat and thorax is broken in most paratypes (complete only in the dorsally striped paratype ZFMK 59947), whereas it is reduced to a light spot on the thorax in ZFMK 59946. None of the paratypes has a distinct brown spot in the tympanic region or a light stripe on the upper lip.

ZFMK 57429 was pictured in life by GLAW & VENCES (1994) as color photo 101. The iris was golden, the pupil probably of horizontal shape. Dorsum was olive greenish with dark grey-brown markings. Patterns were similar to those in preservative. Distinct white tubercles were present on the flanks. The fingertips were white.

Other specimens. - Additional specimens are kept in the herpetological collection of the University of Antananarivo, Madagascar. Collection data are the same as for the type material.

Distribution. – Only known from the type locality.

Habitat and habits. Males and females were found during day and night along stony brooks in the rain forest. No calling activity could be observed. Specimens were mostly sitting on mossy stones in the brooks.

Subgeneric attribution. Tentatively placed in the subgenus *Gephyromantis*, *Mantidactylus boulengeri* group.

A NEW SPECIES FROM NOSY MANGABE

In 1953, A. GRANDISON described *Rhacophorus webbi* which had been collected by C. S. WEBB in the small Malagasy offshore island Nosy Mangabe GUIBÉ (1978) transferred the species to the genus *Gephyromantis*. BLOMMERS-SCHLÖSSER & BLANC (1991) included the species in *Mantidactylus*. The presence of a paired subgular vocal sac in combination with connected lateral metatarsalia were the main characters used by GLAW & VENCES (1994) to group *Mantidactylus webbi* within the subgenus *Gephyromantis*. However, it differs from all other members of this taxonomic group by the laterally white (not blackish) vocal sac (GLAW & VENCES, 1992*a*).

ANDREONE (1993) made reference to an unidentified *Mantidactylus* species of which two specimens had been photographed at Nosy Mangabe. It was similar to *M. webbi* by general habitus but differed by the more finely granular skin (coarsely granular in *M. webbi*) and by body and iris coloration. During a second visit of F. ANDREONE to Nosy Mangabe, a third specimen of this form was seen and collected. Further study has confirmed that it belongs to an undescribed species of *Mantidactylus* which is superficially similar to *M. webbi*. Before the formal description of the new species, we present here a short diagnosis and a review of biology and distribution of *M. webbi*.

Source MNHN, Paris

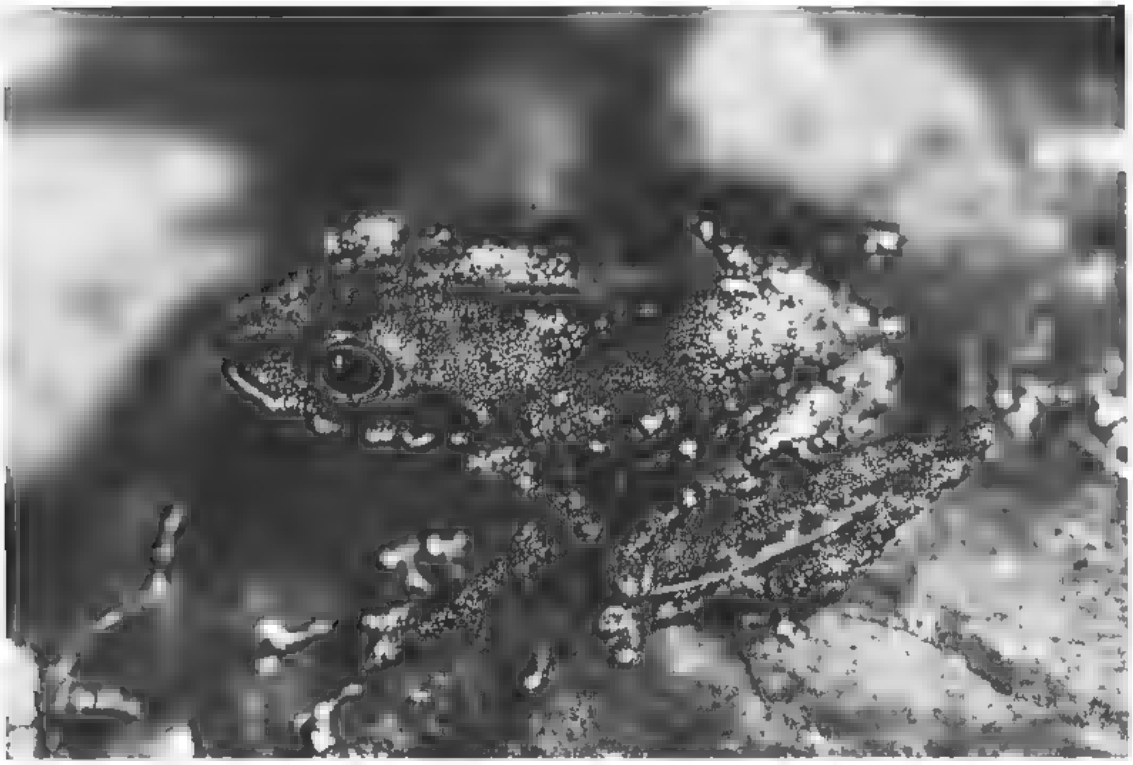

Fig 4. — Specimen of *Mantidactylus webbi* from Nosy Mangabe, January 1991 (not preserved).

Mantidactylus webbi (Grandison, 1953)

Rhacophorus webbi Grandison, 1953
Gephyromantis webbi: GUIBÉ, 1978.
Mantidactylus webbi BLOMMERS-SCHLÖSSER & BLANC, 1991, GLAW & VENCES 1992*a-b*, 1994, ANDREONE, 1993.
Mantidactylus (Gephyromantis) webbi: DUBOIS, 1992.

Diagnosis. — A small olive-greenish frog which belongs to the genus *Mantidactylus* as is evident from the presence of femoral glands in the males. Metatarsal tubercles are rudimentary. Nostrils are situated dorsolaterally. The paired subgular vocal sac of the male is characteristic for most species of the subgenera *Phylacomantis* and *Gephyromantis*. The connected lateral metatarsalia in combination with the small size and greenish coloration allow a distinction from all *Phylacomantis*, whereas the presence of a laterally white (instead of blackish) vocal sac in males is a unique feature of *M. webbi* and can serve as an immediate recognition character.

Holotype. — BM 1953.1.2.34, adult female, SVL 33.3 mm. The original description (GRANDISON, 1953) included a picture of this specimen.

Distribution. — The type locality is the small Malagasy offshore island Nosy Mangabe. On the mainland near Nosy Mangabe we found this species at Voloina and Navana (GLAW & VENCES, 1992*a*) and at Ambanizana (ANDREONE, unpublished) Specimens from Andohahela

Source MNHN, Paris

in south-eastern Madagascar (MNHN 1975.951-952) were tentatively excluded from *M. webbi* by GLAW & VENCES (1994); however, after detailed measurements of these specimens (see tab. 1), we consider them as *M. webbi* pending further study.

Habitat and habits. — Activity and calls were noticed only during the day. The species lives and calls on big mossy stones along brooks in primary forest and was never found at distances of more than 20 m from the water (GLAW & VENCES, 1992*a*; ANDREONE, 1993). Two egg clumps (one found in March, one in August), each with 7 yellowish eggs (diameter 4 mm), were found on rocks in the brooks (GLAW & VENCES, 1992*a*; ANDREONE, 1993). One of the egg clumps was guarded by a male during the night (ANDREONE, 1993). Four additional clumps of similar size were observed by F. ANDREONE in August 1994 at Nosy Mangabe.

Calls. — The advertisement call has been described by GLAW & VENCES (1992*a*). It is a series of up to 10 unharmonious notes (note repetition rate 6.25/s). Note duration is 26-46 ms, duration of intervals between notes is 122-168 ms, and frequency ranges from 0.5 to 5 kHz.

Subgeneric attribution. — Presently placed in the subgenus *Gephyromantis*, *Mantidactylus boulengeri* group (GLAW & VENCES, 1994).

Mantidactylus silvanus sp. nov.

Diagnosis. — A medium-sized member of the genus *Mantidactylus* as is evident from the presence of distinct femoral glands and lack of nuptial pads in males (females unknown). General color olive-greenish to light brown. The most distinctive character is the highly protruding inner metatarsal tubercle which allows a distinction from all other *Mantidactylus* thus far known. Additionally, *M. silvanus* can be distinguished from the superficially similar *M. lugubris*, young *M. microtympanum*, and *M. webbi* by the same character combinations specified above in the diagnosis of *M. rivicola*. A distinction from *M.* cf. *malagasius* (from Marojezy) can easily be made by the smaller size and the granular skin of that species.

M. silvanus is most similar and probably closely related to *M. rivicola*. Besides the size differences between both species, the following distinctive characters can be used for diagnosis: *M. rivicola* has a more granular skin on the dorsum, a larger distance between the femoral glands, a less developed metatarsal tubercle, and a more granular tympanic region with a more curved and rather discontinuous and irregular supratympanic fold (smooth, with a regular fold which is curved only partly, in *M. silvanus*).

Derivatio nominis. — Classical Latin *Silvanus* (name of the God of forests). This species lives in lowland forest.

Holotype. — MRSN A1661, adult male, from Nosy Mangabe Special Reserve, northeastern Madagascar, collected by F. ANDREONE on 27.06.1995.

Description of the holotype. — See tab. 1 for measurements. Body more or less slender. Widest part of head clearly wider than widest part of body. Dorsal outline of head triangular, snout rather long. Snout protruding over upper jaw in lateral view. Nostrils

Source MNHN, Paris

Fig 5 – Holotype of *Mantidactylus silvanus*, MRSN A1661, adult male, Nosy Mangabe Special Reserve, 27.06.1995.

protruding with lateral openings. Loreal region slightly concave. Tympanum distinct, its diameter accounting for about 3/5 of eye diameter. Tympanic region without granules. Distinct and continuous supratympanic fold which runs rather straight and curves downwards only at a certain point behind the tympanum, near the foreleg insertion. Forelegs and hindlegs slender. Finger discs enlarged, semicircular to triangular. No webbing between fingers Comparative finger length: 1 < 2 < 4 < 3 Toe discs enlarged, smaller than finger discs. Traces of webbing between toes. Comparative toe length: 1 < 2 < 3 ≤5 < 4. Inner metatarsal tubercle large, protruding, resembling a "sixth toe", its size 1.8 × 0.5 mm. Outer metatarsal tubercle not recognizable. Foot length (not including tarsus) 13.5 mm. Lateral metatarsalia connected. Dorsal skin rugged to finely granular with few small dispersed tubercles. Oblique femoral glands, nearly touching each other, their diameter 2.2 × 1.5 mm. Small but distinct vomerine teeth. No externally recognizable vocal sac (neither distinct dark color in the angle of the lower jaw nor a skin fold is visible).

Coloration of the holotype. – After one month in alcohol, the head, dorsum and flanks are marbled brownish and light grey. Fore- and hindlimbs show distinct brown crossbands which extend to the fingers and toes. The tips of the fingers are grey The eyes are dark. The lower lip is dark, broken by some alternating light spots, resulting in a pattern which partly corresponds to the markings on the upper lip. The tympanum is light brown. There is no distinct brown spot from the eye through tympanum to the insertion of foreleg and no light stripe along the upper lip. Throat, venter and the anterior ventral

Source MNHN, Paris

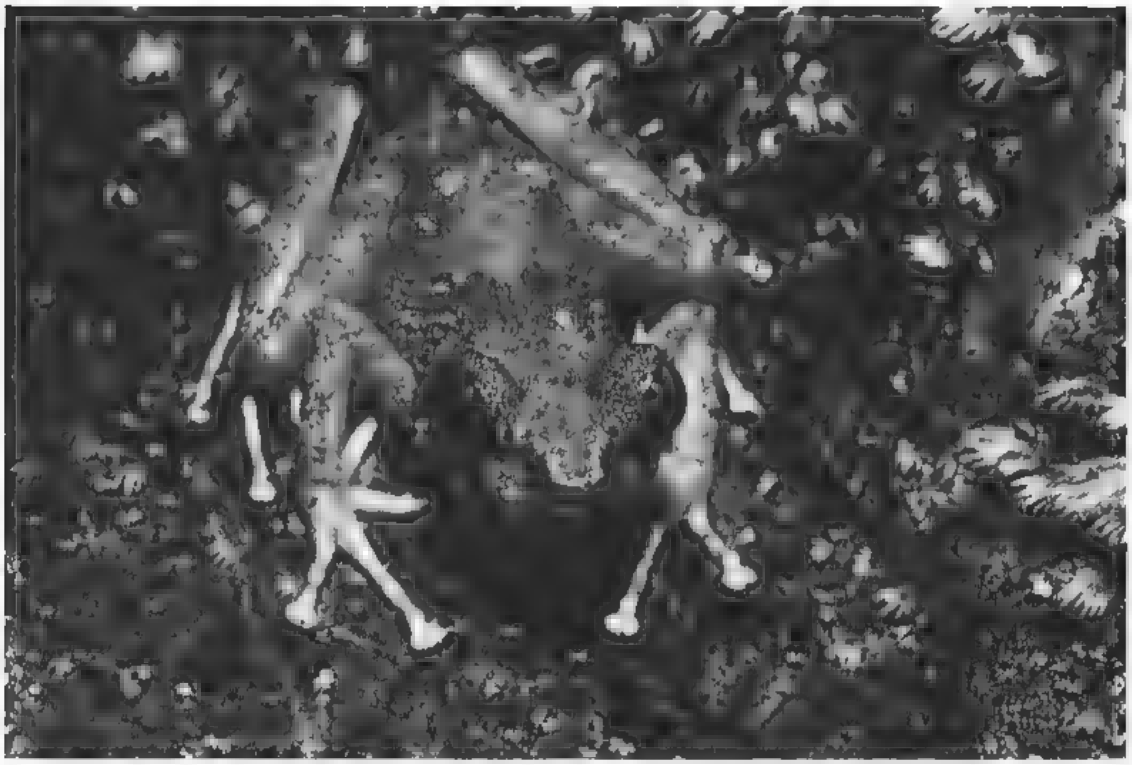

Fig. 6. – Specimen of *Mantidactylus silvanus* from Nosy Mangabe, August 1988 (not preserved).

region of the femur are light grey without distinct spots. The posterior region of the femur, i.e. between the femoral glands and anus, as well as the other ventral parts of the limbs, are more dark grey. An indistinct and incomplete white stripe runs ventrally from the tip of snout to the thorax.

Coloration in life was yellowish-beige marbled with olive grey and with two dark transverse markings. The hindlegs were also beige with crossbands which were less distinct than after preservation. The toes and fingers, especially the fingertips, were white. The pupil was horizontal, the iris had copper-red coloration. The venter and ventral aspect of femurs were pinkish translucent, with some silvery white color on the belly.

Other specimens. – Photographs of two specimens from Nosy Mangabe which were not collected are available. Coloration patterns are in agreement with those of the holotype.

Distribution. – Only known from the type locality.

Habitat and habits. – The limited available data refer to the three specimens observed by F. Andreone. The holotype was collected at night (about 21 h 00) whilst perched on a leaf of a small tree, about 1 m above the water level of a very small brook flowing through large stones in primary forest. In sympatry a larger group of calling males of *Mantidactylus redimitus* were observed. The second and third specimens were photographed at night along a forest brook near a small cascade.

Subgeneric attribution. – We tentatively include this species in the subgenus *Gephyromantis*, *Mantidactylus boulengeri* group.

Source MNHN, Paris

DISCUSSION

The divergence of the different *Mantidactylus* groups is evident in terms of the synapomorphies in tadpole morphology, but is much less obvious in adult morphology (GLAW & VENCES, 1994). *Mantidactylus rivicola* and *M. silvanus* show clear affinities to members of the subgenus *Gephyromantis* sensu GLAW & VENCES (1994), especially to *M. webbi*. However, reproductive biology of none of these three species is sufficiently understood. The reproductive mode of only two species of the subgenus, *M. eiselti* (*M. boulengeri* group) and *M. asper* (*M. asper* group), are known. Both undergo direct development in terrestrial eggs (BLOMMERS-SCHLÖSSER, 1979; GLAW & VENCES, 1994). Little doubt remains that *M. boulengeri*, the subgeneric type species, has a similar breeding biology, and that direct development is typical for *Gephyromantis*.

Egg clutches attributed to *M. webbi* were found overhanging brooks, thus not independent from water (GLAW & VENCES, 1992*a*; ANDREONE, 1993). It can be assumed that this species has a different breeding biology, with more or less developed tadpoles dropping into the brook. A similar reproductive mode may exist in *M. rivicola* and *M. silvanus*, which also live along brooks, but is very unlikely for *M. klemmeri*, which, like *M. eiselti*, calls far from any water body.

The lack of available information points to the fact that new data on the subgenera *Gephyromantis*, *Laurentomantis* and *Phylacomantis* are needed. The phylogenetic relationships between the various species of these groups, some of which are probably paraphyletic, need to be resolved as well as their status within the genus *Mantidactylus*.

Such a revision would also be useful for conservation purposes. Many species of the subgenera *Gephyromantis*, *Phylacomantis* and *Laurentomantis* are confined to primary rainforest habitats. Exceptions are *M. eiselti* and *M. thelenae*, which also inhabit secondary fern scrub at the forest edge or in clearings, *M. b. boulengeri*, which also lives in wood patches along brooks or in secondary eucalyptus forest, and *M. granulatus*, which can live in degraded forest along brooks and small streams. Nevertheless, these frogs are one of the Malagasy anuran groups which are mostly restricted to little disturbed habitat. Therefore they may be useful as indicator taxa for the assessment of the status and degree of forest habitat degradation. Since many of these species are active during the day and may easily be located by means of their characteristic calls, their presence can be established even by little experienced researchers. Detailed knowledge of the systematic status, distribution range and habitat preferences of each species are basic requirements if they are to be used as habitat indicators.

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Source MNHN, Paris

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Alytes, 1997, **14** (4): 147-174.

A review of the *Eleutherodactylus milesi*-like frogs (Anura, Leptodactylidae) from Honduras with the description of four new species

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Four new species of the *Eleutherodactylus milesi* group are described from the Caribbean versant of Honduras. *Eleutherodactylus stadelmani*, recently resurrected from the synonymy of *E. milesi*, is shown to represent a valid species, but not in the recently suggested concept. A key to the identification of the Honduran members of the *E. milesi* group is also provided.

Introduction

McCranie et al. (1989) described two new species of streamside frogs of the *Eleutherodactylus milesi* group (*E. chrysozetetes* and *E. cruzi*) from Honduras. These authors also assigned frogs from seven localities across northern Honduras to the species *E. milesi* Schmidt, 1933, although noting that variation occurred among some of these populations in several characters previously used by Savage (1975) to diagnose the species. Campbell (1994) described two new species of this group (*E. adamastus* and *E. trachydermus*) from Guatemala and resurrected *E. stadelmani* Schmidt, 1936 (type locality. Portillo Grande, Departamento de Yoro, Honduras) from the synonymy of *E. milesi*. Campbell (1994) examined two paratypes of *E. stadelmani* (sample 4 of McCranie et al., 1989) and concluded that they were conspecific with a series of frogs from the Quebrada de Oro region, Departamento de Atlántida, Honduras (sample 5 of McCranie et al., 1989) on the one hand, and were distinct from *E. milesi* (sample 6 of McCranie et al., 1989) from the Sierra de Omoa of northwestern Honduras on the other. Campbell (1994) also examined the frogs in samples 2 and 7 of McCranie et al. (1989), but was undecided on the specific identities of these specimens Unfortunately, the two paratypes of *E. stadelmani* examined by Campbell (1994) are subadults. Had he examined the adults in the type series of *E. stadelmani*, he might have reached different conclusions. Examination by us of the entire type series of *E. stadelmani*, plus a series of frogs recently collected from nearby localities, demonstrates that *E. stadelmani* is indeed a distinct species. Re-examination of the Quebrada de Oro series demonstrates that this population also

Source MNHN, Paris

represents a species distinct from *E. milesi* (as noted by CAMPBELL, 1994) and *E. stadelmani* as well. In recent years, we have also collected a small series of *E. milesi*-like frogs from forested hillsides well above streams, a previously unknown habitat for frogs of this group. Additionally, a field party from the Museum of Vertebrate Zoology made an incidental collection of *E. milesi*-like frogs while conducting salamander studies in the Sierra de Omoa. Examination of the forest specimens and the MVZ specimens demonstrates that each series also represents an undescribed species (a few additional specimens that are conspecific with the MVZ series were also located in the FMNH and MCZ collections). Finally, re-examination of the series of *E. milesi*-like frogs from the Sierra de Agalta (samples 2 and 3 of MCCRANIE et al., 1989) demonstrated that these specimens represent an undescribed species as well.

Early in this study, when it became apparent that several populations of *E. milesi*-like frogs were morphologically distinct, a decision was made to attempt to collect tissues from as many of these populations as possible. It was hoped that the tissues would substantiate the taxonomic conclusions based on morphological data. Thus, in February 1995, the senior author visited the still pristine Quebrada de Oro-Cerro Búfalo region where three species of the *milesi* group were known to occur (*E. chrysozetetes*, *E. cruzi*, and *E.* sp. nov.). However, in 10 days and nights of collecting, not a single streamside *Eleutherodactylus* was seen, although three species of forest *Eleutherodactylus* were collected well above the nearest streams (the forest *E milesi*-like frog alluded to above, plus *E. chac* and *E. ridens*). In July 1995, both authors returned to a stream in the Cordillera Nombre de Dios in northern Yoro where *E. stadelmani* was common in July-August of 1991 and 1993 In four daily and nightly visits to this stream by ourselves and/or other members of the field party, no streamside *Eleutherodactylus* were seen, even though there was no change in the streamside vegetation from previous years. *Eleutherodactylus milesi* also was common along small streams that flow into the Rio Cusuco in Parque Nacional El Cusuco, Departamento de Cortés, Honduras, in April 1979, May 1980, August 1982 and July 1983. The senior author searched these same small streams during three days and four nights in August 1992 without seeing a single *E. milesi*. Mario ESPINAL also collected in Parque Nacional El Cusuco on two trips in July-August 1993. Although he collected several specimens of the forest-occurring *E. rostralis* and two species of streamside hylids (*Plectrohyla dasypus* and *P. teuchestes*), no *E. milesi* were collected. These recent collecting efforts suggest that at least some populations of streamside frogs in the *E. milesi* group may be experiencing population declines or have collapsed altogether. Several species of moderate and intermediate elevation streamside frogs have been documented to have disappeared from pristine habitats in Costa Rica and are now feared extinct (K. R. LIPS, J. M. SAVAGE, personal communication). Thus, the possibility exists that one or more of the new species described below may have already vanished from at least their previously known localities.

Source MNHN, Paris

Materials and methods

Museum abbreviations follow Leviton et al. (1985): BMNH, Natural History Museum, London, UK; FMNH, Field Museum of Natural History, Chicago, USA; KU, Museum of Natural History, University of Kansas, Lawrence, USA; LACM, Los Angeles County Museum of Natural History, Los Angeles, USA; MCZ, Museum of Comparative Zoology, Harvard University, Cambridge, USA; MVZ, Museum of Vertebrate Zoology, University of California, Berkeley, USA; ROM, Royal Ontario Museum, Toronto, Canada; UIMNH, University of Illinois Museum of Natural History, Urbana, USA; UMMZ, Museum of Zoology, University of Michigan, Ann Arbor, USA; USNM, National Museum of Natural History, Washington, USA.

The numbered characters in each species diagnosis follow the standard established by Lynch & Duellman (1980). Discussion of some of these characters is expanded in the *E. milesi* and *E. stadelmani* sections as no follow up description is provided for either species. Additional to the specimens referred to the four new species described below (see species descriptions), the following Honduran specimens of the *E. milesi* group were examined, which include the holotypes and all extant paratypes of *E. chrysozetetes*, *E. cruzi*, *E. milesi*, and *E. stadelmani*:

Eleutherodactylus chrysozetetes (30). – *Atlántida*: KU 209035 (holotype), 209036; USNM 497054-81.

Eleutherodactylus cruzi (2). – *Atlántida*. KU 209037 (holotype), 209038.

Eleutherodactylus milesi (89). – *Copán*: KU 209076-79, 209097; *Cortés*: FMNH 4699 (holotype), 4700, 4701 (24), 4702, 4704-11, 4713; KU 209040-57, 209060-75, 209107, 209141, LACM 137298-305; MCZ 17435; UIMNH 39946, UMMZ 120388; USNM 118202.

Eleutherodactylus stadelmani (78). – *Olancho*: USNM 497120-68; *Yoro*: FMNH 21862-64; MCZ 21290 (holotype), 21291-92; USNM 497169-91.

We have not recently examined the BMNH specimen of "*E. milesi*" (O'Shea, 1989, McCranie et al., 1989) reported from the Departamento de Colón, Honduras, and cannot comment upon its specific status. We also follow the lead of Campbell (1994) and do not consider *E. matudai* in this discussion of the *E. milesi* group.

All measurements were made to the nearest 0.1 mm with dial calipers and a dissecting microscope. The following standardized abbreviations for measurements are used (following Campbell, 1994): SVL (snout-vent length), HL (head length tip of snout to angle of jaw), HW (greatest width of head), EL (eye length), E-N (distance between anterior border of eye and posterior border of nostril), TM (tympanum length), E-T (shortest distance between eye and tympanum), TL (tibia length, including covering tissues), FL (distance from posteriormost portion of inner metatarsal tubercle to tip of fourth toe), EW (greatest width of upper eyelid), IOD (shortest interorbital distance), and F3 (disc width of third finger).

Because tympanum condition varies considerably among members of the *milesi* group, we have adopted the following terminology and somewhat subjective criteria. tympanum prominent (annulus distinctly raised and strongly evident throughout its circumference; this condition does not occur in any *milesi* group member); tympanum

Source MNHN, Paris

distinct (tympanum and annulus covered by thin skin, but annulus evident almost throughout its circumference); tympanum indistinct (tympanum and annulus covered by thicker skin, ca. one-half of annulus evident); tympanum very indistinct (tympanum and annulus covered by thick skin, ca. one-third of annulus evident); tympanum hidden (tympanum and annulus completely concealed by thick skin). The fact that the tympanum may vary from one side of the head to the other in some individuals of those *milesi* group species lacking distinct tympana further compounds the use of this feature. In addition, the tympanum condition is sexually dimorphic. We follow CAMPBELL (1994) in the usage of the terms lateral keels and lateral fringes for the ornamentation of the toes and fingers.

Comparative data for the Guatemalan species *E. adamastus* and *E. trachydermus* are taken from CAMPBELL (1994). Snout shape terminology follows HEYER et al. (1990). Color notes in each diagnosis are taken from preserved specimens. Each diagnosis is based upon adults only, unless otherwise stated.

SYSTEMATIC ACCOUNTS

External characters defining the *E. milesi* group include inner tarsal fold absent, dorsum with scattered to numerous tubercles, tympanum distinct to hidden in males and indistinct to hidden in females, and pale para-anal bars or spots commonly present.

First we provide new diagnoses and distributional statements for *E. milesi* and *E. stadelmani*, followed by the description of four new species of *E. milesi*-like frogs from Honduras. Tables 1-2 compare selected characters among the Honduran members of the *E. milesi* group.

Eleutherodactylus milesi Schmidt, 1933
(fig. 1)

Diagnosis. – (1) Skin of dorsum of head and body, flanks, and upper surfaces of limbs not granular, but wrinkled in most specimens, weakly granular in others; numerous tiny to small tubercles on top of head and anterior part of body; tubercles larger on flanks and posterior part of dorsum of body than on rest of dorsum; margin of upper lip smooth to rough; upper lip not flared; row of raised skin, usually discontinuous, with or without tubercles, forming occipital fold from posterior edge of upper eyelid to scapular region; shorter row of raised skin, with or without tubercles, extending from posterior edge of eye, curving downward above tympanum; skin of venter slightly wrinkled, almost smooth; (2) tympanic annulus distinct in males, indistinct in females, length about 47-68 % length of eye in males, 27-47 % in females; tympanum separated from eye in males by distance 29-47 % length of tympanum, 71-118 % in females; (3) snout nearly rounded to rounded in dorsal view, rounded to nearly vertical (with rounded upper end) in profile; canthus rostralis well defined, angular; loreal region concave; (4) upper eyelid 100-118 % interorbital distance, wrinkled, covered with tiny to large tubercles; no cranial crests; (5) vomerine dentigerous processes round to oval in outline, larger than choanae, lateral edge

Source MNHN, Paris

Tab. 1. - Comparison of selected characters of the Honduran members of the *Eleutherodactylus milesi* group. Abbreviations used are: TM, tympanum length; EL, eye length.

Character	*chrysozetetes*	*cruzi*	*epochthidius*	*fecundus*	*milesi*	*omoaensis*	*saltuarius*	*stadelmani*
SVL (mm)								
Males	33 5 - 41 3	27 0 - 33 2	20 9 - 26 9	21.1 - 23 5	19 4 - 25 5	26.2 - 30 0	19 6 - 22 4	27 3 - 33.1
Females	37 3 - 45 6	—	33 1 - 36 7	29.8 37 3	25 0 - 37 1	25 6 - 38 4	—	33.2 - 47.4
Male vocal slits	present	present	present	present	present	absent	present	present
Tympanum								
Males	hidden	hidden[1]	indist. to hidden	indist. to hidden	distinct	distinct	dist. to indist.	hidden[1]
Females	hidden	—	indist. to very indist	indist. to hidden	indistinct	indistinct	very indistinct[2]	hidden
TM/EL								
Males	—	—	34 - 39%	36 - 49%	47 - 68%	72 - 85%	35 46%	—
Females	—	—	29%	34 - 43%	27 - 47%	39 - 52%	—	—
Upper lip	not flared[3]	not flared	not flared	not flared	not flared	flared	not flared	not flared[3]
Toe lateral structure	fleshy fringes	fleshy fringes	fleshy fringes	keel[4]	keel	keel	keel	fleshy fringes

1. Rarely very indistinct
2. In one subadult female, adult females unknown
3. Flared in large females
4. Occasional large females have weakly infolded fringes on toe IV

Source : MNHN, Paris

Tab. 2 . - Toe webbing formulae for the Honduran members of the *Eleutherodactylus milesi* group.

Species	Modal webbing formula
Eleutherodactylus chrysozetetes	I 1 1/3 - 2 II 1 1/3 - 2 1/2 III 2 - 3 1/3 IV 3 1/3 - 2 V
Eleutherodactylus cruzi	I 2 - 2 3/4 II 2 - 3 1/2 III 3^- - 4 IV 4 - 2 1/2 V
Eleutherodactylus epochthidius	I 2 - 2 3/4 II 2 - 3 1/2 III 3 - 4 1/4 IV 4 1/4 - 2 3/4 V
Eleutherodactylus fecundus	I 2 - 2 4/5 II 2 - 3 3/4 III 3 - 4 1/4 IV 4 1/4 - 2 3/4 V
Eleutherodactylus milesi	I 2^+ - 2 4/5 II 2 - 3 3/4 III 3 - 4 1/2 IV 4 1/2 - 3^- V
Eleutherodactylus omoaensis	I 2 - 2 4/5 II 2 - 3 3/4 III 3 - 4 1/2 IV 4 1/4 - 2 3/4 V
Eleutherodactylus saltuarius	I - II 2^+ - 3 4/5 III 3^+ - 4 1/2 IV 4 1/2 - 3^- V
Eleutherodactylus stadelmani	I 2 - 2 3/4 II 2 - 3 1/2 III 3^- - 4 IV 4 - 2 1/2 V

of dentigerous process not extending laterally to median portion of choanae; (6) vocal slits and pale nuptial pads present in males; (7) first finger shorter than second or first and second fingers about equal in length; fingers bearing moderately well developed pads; discs on fingers III-IV slightly broader than long; disc width on finger III 14-36 % length of tympanum in males, 25-56 % in females; (8) fingers bearing lateral keels; (9) no ulnar tubercles on forearm in most specimens, ulnar tubercles on forearm occasionally arranged in linear series, but not developed into fold in those specimens with weakly granular dorsa; antebrachium smooth or with few tiny tubercles; (10) heel varying from nearly smooth with few tiny tubercles to covered with about 30 small tubercles; no linear series of tubercles or fold along outer edge of tarsus; no inner tarsal fold; (11) inner metatarsal tubercle oval to elongate (length about 2-3 times width), 2-3 times size of small rounded outer metatarsal tubercle; no plantar tubercles; (12) toes bearing well developed lateral keel, webbing moderate for *E. milesi* group (modal formula I 2^+ – 2 4/5 II 2 – 3 3/4 III 3 – 4 1/2 IV 4 1/2 – 3^- V); discs on toes III-IV about as broad as or slightly broader than those on fingers III-IV; (13) dorsum of head and body pale brown to dark brown; thin, pale middorsal stripe rarely extending from level posterior to tympanum to vent; larger tubercles with slightly paler colored tips; obscure pale interorbital bar frequently present; dark bars present on upper lip; some individuals with conspicuous pale blotch below canthus; darker crossbars present on dorsal surfaces of limbs; para-anal pale bars or spots well defined, indistinct, or absent; posterior of thigh heavily flecked with brown, with paler brown tiny to small spots or mottling; belly and venter of thigh cream colored, lightly to moderately flecked with brown, belly flecking sometimes coalesced into scattered spots, chin and throat more heavily flecked, especially in some males; (14) adults moderate-sized relative to other members of *E. milesi* group, 25 males 19.4-25.5 (x = 21.8) mm SVL, 21 females 25.0-37.1 (x = 32.1) mm SVL.

Distribution. – Moderate and intermediate elevations (1050 to 1720 m) of the sierras Omoa and Espíritu Santo of northwestern Honduras (fig. 2). See *Materials and Methods* for a list of specimens examined. The habitat surrounding this species' type locality ("mountains west of San Pedro [Sula], Honduras. Altitude 4500 feet."; SCHMIDT, 1933: 18)

Source MNHN, Paris

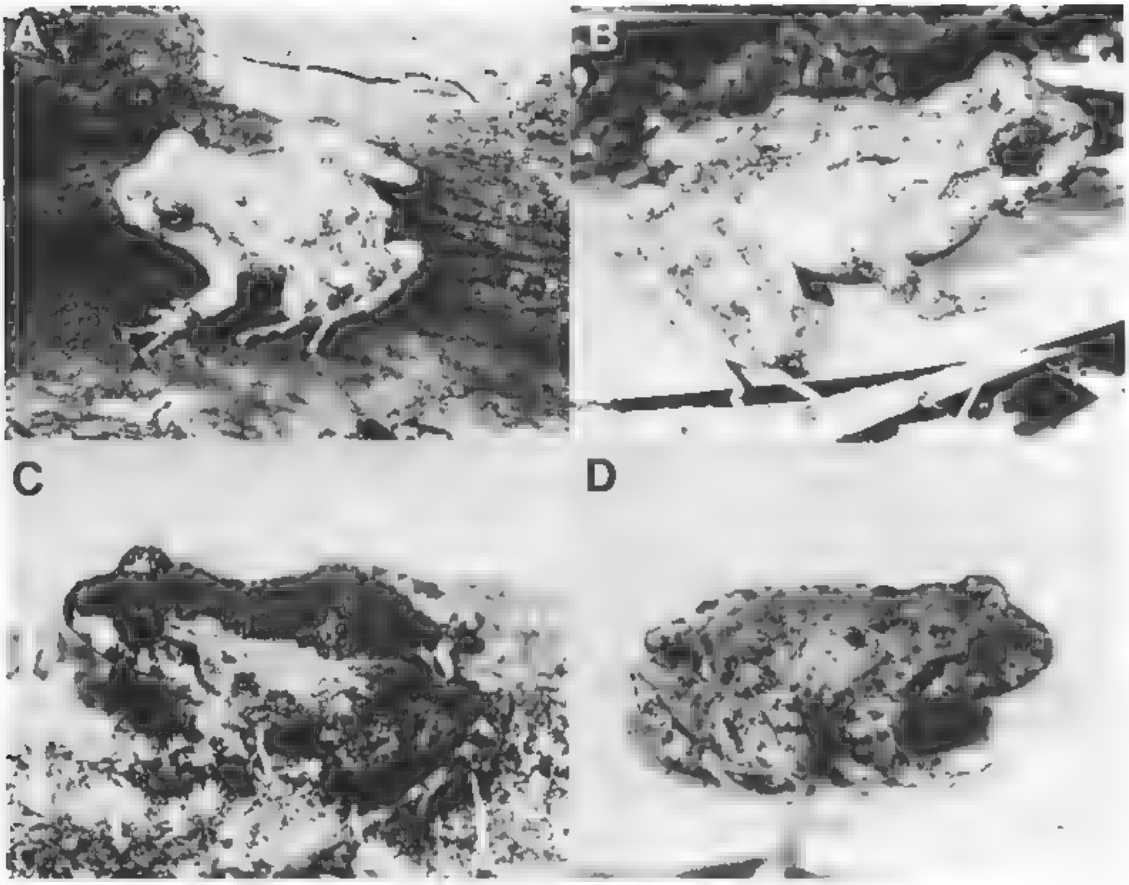

Fig. 1. – (A) Adult male (KU 209049) of *E. milesi*, SVL 22.5 mm. (B) Adult female (USNM 497172) of *E. stadelmani*, SVL 46.8 mm. (C) Adult female (USNM 497098) of *E. fecundus*, SVL 33.3 mm. (D) Adult male (USNM 497115) of *E. saltuarius*, SVL 22.4 mm. Photograph (A) by Jim Bridges, remainder by senior author.

has been severely altered since Schmidt collected the type series. It is unlikely that this species presently occurs at its type locality. Evidence also suggests that the El Cusuco population is experiencing a population decline, or has collapsed altogether (see *Introduction*).

Eleutherodactylus stadelmani Schmidt, 1936
(fig. 1)

Diagnosis. – (1) Skin of dorsum of head and body, flanks, and upper surfaces of limbs not granular to moderately granular, frequently wrinkled, numerous tiny to moderate-sized tubercles on top of head and anterior part of body; tubercles larger on flanks and posterior portion of body than rest of dorsum; margin of upper lip smooth to rough; upper lip usually not flared, sometimes slightly flared in large females; row of raised skin, frequently tuberculate, continuous or discontinuous, forming occipital fold from posterior

Source MNHN, Paris

edge of upper eyelid to scapular region; shorter row of raised skin, frequently tuberculate, extending from posterior edge of eye, curving downward above tympanum; other short rows of raised skin sometimes present dorsolaterally and on mid-back region; skin of venter usually slightly wrinkled, almost smooth, although moderately wrinkled in some specimens with more granular dorsa; (2) tympanic annulus usually hidden in males (rarely very indistinct), hidden in females; (3) snout nearly rounded to rounded in dorsal view, rounded to nearly vertical (with rounded upper end) in profile; canthus rostralis well defined, angular; loreal region concave; (4) upper eyelid 102-124 % interorbital distance, covered with tiny to large tubercles; no cranial crests; (5) vomerine dentigerous processes round, oval, or somewhat triangular in outline, slightly larger than choanae in males, much larger than choanae in females, lateral edge of dentigerous process not extending laterally to median portion of choanae; (6) vocal slits and pale nuptial pads present in males; (7) first finger shorter than second or first and second fingers about equal in length; fingers bearing moderately well developed pads; discs on fingers III-IV slightly broader than long; (8) fingers bearing lateral keels; (9) no ulnar tubercles on forearm in most specimens, ulnar tubercles on forearm occasionally arranged in linear series, but not developed into fold in those specimens with more granular dorsa; antebrachium smooth with few small to moderate-sized tubercles; (10) heel covered with about 20-40 tiny to moderate-sized tubercles; no linear series of tubercles along outer edge of tarsus; no inner tarsal fold; (11) inner metatarsal tubercle oval to elongate (length about 2-3 times width), 3-5 times size of small rounded outer metatarsal tubercle; no plantar tubercles; (12) toes bearing well developed lateral fleshy fringes that fold ventrally; webbing well developed for *E. milesi* group (modal formula I 2 — 2 3/4 II 2 — 3 1/2 III 3 — 4 IV 4 — 2 1/2 V); discs of toes III-IV about as broad as or slightly broader than those on fingers III-IV; (13) dorsum of head and body pale brown to dark brown, frequently with darker brown mottling or spotting, some specimens with broad, pale dorsolateral longitudinal stripe, others with broad, pale middorsal band beginning on snout and extending laterally to cover upper eyelids and gradually narrowing to V-shape above vent; larger tubercles frequently with slightly paler colored tips; obscure pale interorbital bar frequently present; dark bars present on upper lip; some individuals with conspicuous pale blotch below canthus; darker crossbars present on dorsal surfaces of limbs; para-anal pale bars or spots well defined, indistinct, or absent; posterior of thigh heavily flecked with brown, with paler brown tiny to small spots or mottling; belly and venter of thigh cream colored, lightly to moderately flecked with brown, chin and throat more heavily flecked, especially in some males; occasional specimens have dark flecks on belly, chest, chin, and throat concentrated into mottled or vermiculate pattern; (14) adults large relative to other members of *E. milesi* group, 18 males 27.3-33.1 (x = 30.2) mm SVL, 19 females 33.2-47.4 (x = 39.8) mm SVL.

Comparisons. — *Eleutherodactylus stadelmani* is easily distinguished from *E. milesi* by its larger size (see above and tab. 1), tympanum condition (hidden or rarely very indistinct in male and hidden in female *stadelmani* versus distinct in male and indistinct in female *milesi*), toe margin structure (well developed lateral fleshy fringes that fold ventrally in *stadelmani* versus lateral keels in *milesi*), and amount of toe webbing (see above and tab 2). *Eleutherodactylus stadelmani* is apparently most closely related to *E. cruzi* (the latter known only from 1520 m at a single locality in the central portion of the Cordillera Nombre de Dios, Departamento de Atlántida, Honduras), differing from that species only

Source MNHN, Paris

in color pattern (no pale middorsal stripe in *stadelmani* versus thin, pale middorsal stripe extending from tip of snout to just above vent in *cruzi*) and skin texture (row of raised skin, that is frequently tuberculate, forming well developed occipital fold, numerous tiny to moderate-sized tubercles on heel, and upper eyelid with many tiny to large tubercles in *stadelmani* versus occipital fold indistinct to poorly developed, heel mostly smooth with only tiny tubercles, and much of upper eyelid smooth or wrinkled in *cruzi*). *Eleutherodactylus chrysozetetes* (known only from 880 to 1130 m in the central portion of the Cordillera Nombre de Dios, Departamento de Atlántida, Honduras) is similar to *E. stadelmani* in having well developed fleshy fringes on the toe margins and hidden tympana. However, *E. stadelmani* differs from *E. chrysozetetes* in smaller male size (see tab. 1) and by having less toe webbing (see tab. 2). *Eleutherodactylus stadelmani* is most easily distinguished from *E. adamastus* of Guatemala by tympanum condition (annulus usually hidden, rarely very indistinct in male and hidden in female *stadelmani* versus distinct in male and indistinct in female *adamastus*) and toe margin structure (well developed lateral fleshy fringes in *stadelmani* versus lateral keels in *adamastus*). *Eleutherodactylus stadelmani* can be distinguished from *E. trachydermus* of Guatemala by skin texture (dorsal surfaces not granular to moderately granular and ventral surfaces usually slightly wrinkled, almost smooth in *stadelmani* versus dorsal surfaces strongly granular and ventral surfaces coarseley wrinkled in *trachydermus*), male tympanum condition (annulus usually hidden, rarely very indistinct in *stadelmani* versus indistinct in *trachydermus*) and chin and throat coloration (lightly to heavily flecked with brown in *stadelmani* versus chin and throat with heavy suffusion of dark gray melanophores to almost uniformly brown in *trachydermus*).

Distribution. – Isolated localities at moderate and intermediate elevations (1125 to 1900 m) of northern Honduras from the western portion of the Cordillera Nombre de Dios southward to Montaña de Pijol and eastward to Parque Nacional La Muralla in northwestern Olancho (fig. 2). See *Materials and Methods* for a list of specimens examined. The habitat surrounding this species' type locality ("Portillo Grande, Yoro, Honduras, at 4800 feet altitude"; Schmidt, 1936: 44) has been severely altered since the type series was collected and it is unlikely that the species still occurs in the region. Evidence also suggests that the population at the single known locality for the species in the western Cordillera Nombre de Dios may also be declining (see *Introduction*).

Eleutherodactylus omoaensis sp. nov.

Holotype – MVZ 115286, adult male, from about 10 airline km WSW San Pedro Sula on road to Perú (15°28'N, 88°06'W), elevation 1150 m, Sierra de Omoa, Departamento de Cortés, Honduras, 9 February 1974, James Kezer and James F. Lynch.

Paratypes. – Sixteen specimens: MVZ 115283-84, 115287-88 and 115290, all adult males, and MVZ 115281-82, 115285 and 128749-52, all adult females, all with same locality and data as holotype; MCZ 21295-96, both adult males, and FMNH 21820 and 21829, both adult females, all from Montaña Santa Ana W of San Pedro Sula, Departamento de Cortés, Honduras.

Source MNHN, Paris

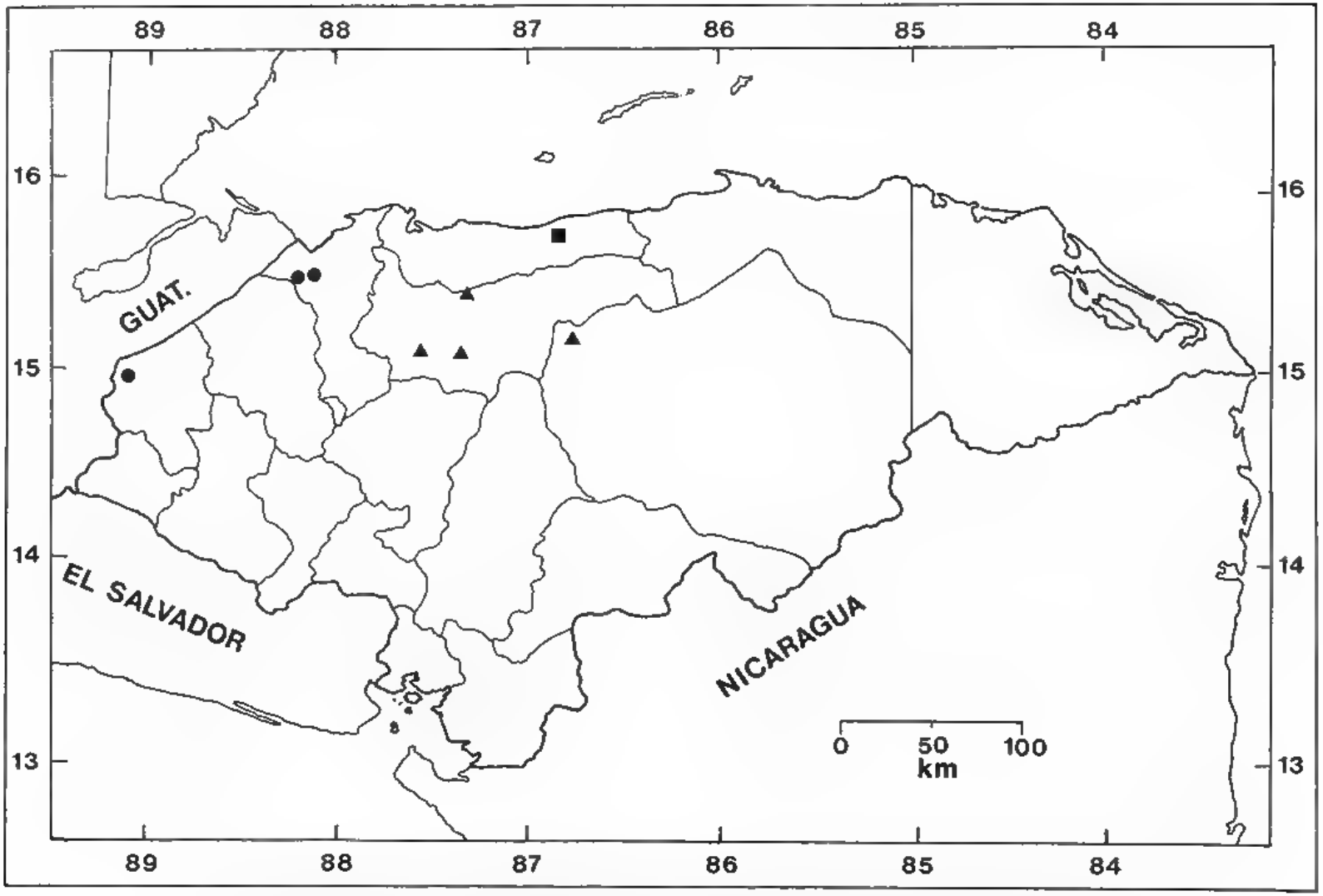

Fig. 2. – Distribution of four species of the *Eleutherodactylus milesi* group in Honduras. Circles: *E. milesi*; triangles: *E. stadelmani*; square: *E. chrysozetetes* and *E. cruzi*. A single symbol may represent more than one locality.

Source : MNHN, Paris

Referred specimens – Seven specimens: MVZ 128754, subadult male, and MVZ 115289 and 128753, both subadult females, same locality and data as holotype; MCZ 21298, subadult male, MCZ 21299, subadult female, and MCZ 21297, juvenile female, all from Montaña Santa Ana W of San Pedro Sula, Departamento de Cortés, Honduras; FMNH 4677, juvenile, from Cañon Santa Ana W of San Pedro Sula, Departamento de Cortés, Honduras.

Diagnosis. – (1) Skin of dorsum varying from not granular, but wrinkled, to strongly granular, with numerous tiny to moderate-sized tubercles, skin of venter slightly wrinkled, almost smooth in many specimens, coarsely wrinkled in those specimens with strongly granular dorsa; (2) tympanic annulus distinct in males, indistinct in females; (3) snout semicircular to nearly rounded in dorsal view, rounded in profile; (4) upper eyelid 100-125 % interorbital distance, usually covered with tiny to large tubercles, rarely wrinkled with relatively few tubercles; no cranial crests; (5) vomerine dentigerous processes oval to nearly triangular in outline; (6) vocal slits absent, pale nuptial pads present in males; (7) first finger shorter than second or first and second fingers about equal in length; fingers bearing moderately well developed pads; (8) fingers bearing lateral keels, (9) ulnar tubercles indistinct; (10) heel bearing small to moderate-sized tubercles; no linear series of tubercles along outer edge of tarsus; no inner tarsal fold; (11) inner metatarsal tubercle elongate, 3-4 times size of small rounded outer metatarsal tubercle; no plantar tubercles; (12) toes bearing well developed lateral keels, webbing moderate (fig. 3) for *E. milesi* group (modal formula I 2 – 2 4/5 II 2 – 3 3/4 III 3 – 4 1/2 IV 4 1/4 – 2 3/4 V); discs of toes III-IV about as broad as or slightly broader than those on fingers III-IV; (13) dorsum of head and body medium brown to dark brown, some specimens with broad, pale dorsolateral longitudinal stripe, others with broad, pale middorsal band beginning on snout and extending laterally to cover upper eyelids and gradually narrowing to V-shape above vent; para-anal pale bars or spots indistinct, occasionally absent, belly and venter of thigh cream colored, lightly to moderately flecked with brown, chin and throat more heavily flecked, especially in some males; (14) adult males large and adult females moderate-sized relative to other members of *E milesi* group, 8 males 26.2-30.0 (x = 28.1) mm SVL, 9 females 25.6-38.4 (x = 32.2) mm SVL.

Comparisons. – *Eleutherodactylus omoaensis* is apparently most closely related to *E. milesi* (the latter also known from the Sierra de Omoa). These two species have similar tympanum conditions, toe webbing, and toe margin structure. *Eleutherodactylus omoaensis* differs from *E. milesi* by having flared upper lips (not flared in *milesi*), broader heads (HW 44-48 % of SVL in male and 43-49 % in female *omoaensis* versus 39-43 % in male and 39-42 % in female *milesi*), adult males lacking vocal slits (present in *milesi*), larger adult male size (see above and tab. 1), and larger tympanum size in adult males (see tab. 1). *Eleutherodactylus omoaensis* can be distinguished from all other members of the *E. milesi* group by the following combination of characters: relatively large adult male size and moderate adult female size; tympanic annulus distinct in males and indistinct in females; males lacking vocal slits; moderate toe webbing; and lateral keels on toes.

Measurements of holotype (mm). – SVL 30.0; HL 13.6, HW 14.0; EL 4.0, E-N 3.0, TM 3.4; E-T 1.2; TL 15.5; FL 15.0; EW 3.7; IOD 3.4; F3 0.6.

Colors of holotype in preservative. – Dorsum of head and body dark brown, most of larger tubercles with pale gray tips, dark crossbars on limbs not well marked; iris gray; pale inter-

Source MNHN, Paris

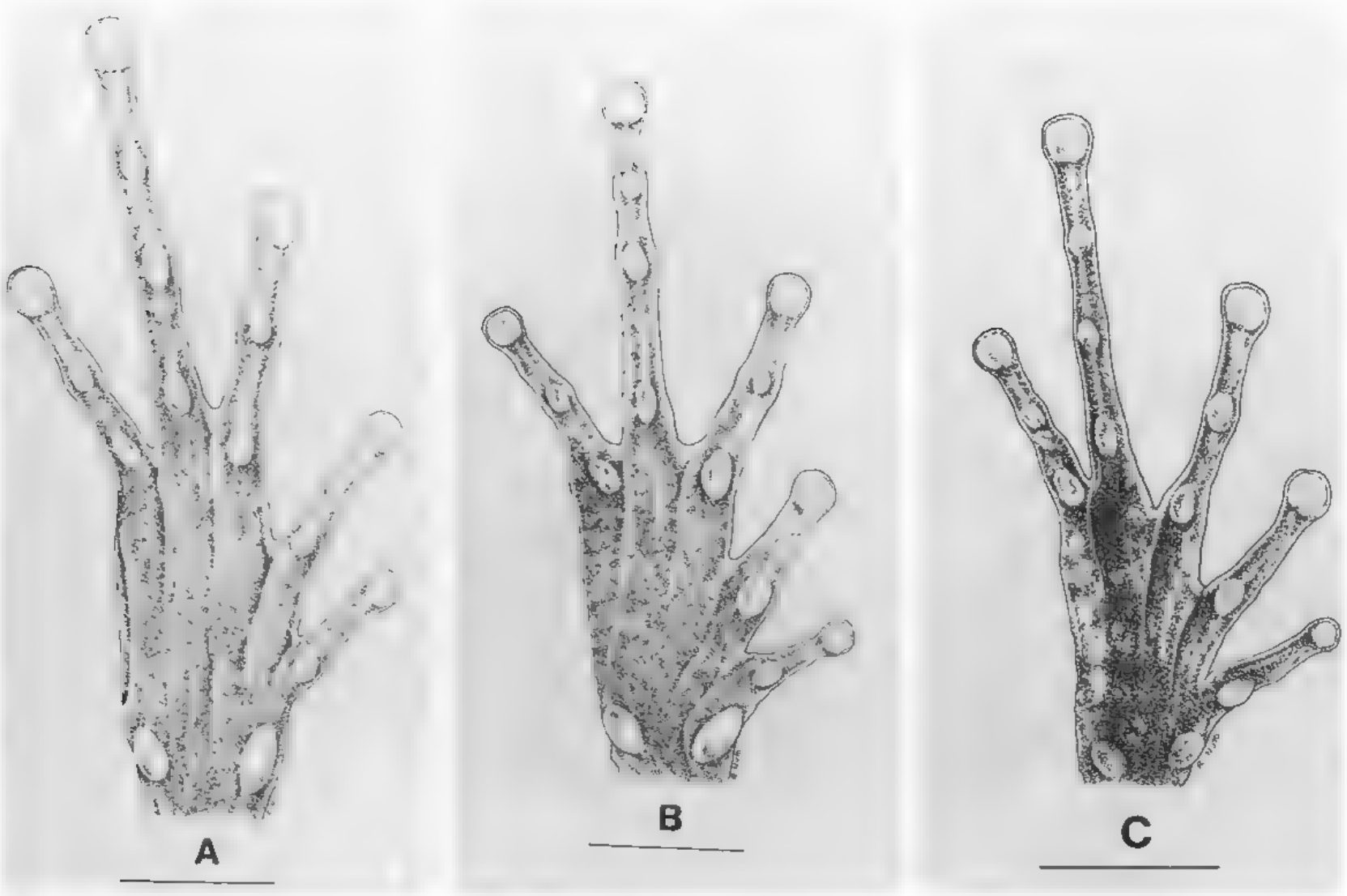

Fig 3. – Ventral view of right foot of (A) *E. omoaensis* (MVZ 115282), (B) *E. fecundus* (USNM 497099) and (C) *E. saltuarius* (USNM 497115). Each scale bar equals 5 mm. The foot structure of *E. epochthidius* resembles that of *E fecundus* except that fleshy fringes are present on toes III-IV or toe IV.

Source : MNHN, Paris

orbital bar absent; dark bars on upper lip very obscure; posterior of thigh heavily flecked with brown, with small, pale brown spots, para-anal pale bar indistinct; belly and venter of thigh cream colored, lightly to moderately flecked with brown, chin, throat, and chest more heavily flecked; palmar and plantar surfaces brown with tiny, scattered pale spots.

Description. – The following measurements and proportions are based on the entire type series of eight males and nine females. Head usually wider than long (width 98-109 % of length); HW 43-49 % of SVL; HL 43-46 % of SVL in males, 41-47 % in females; snout semicircular to nearly rounded in dorsal view, rounded in profile, E-N 9-11 % of SVL; upper eyelid usually covered with tiny to large tubercles, upper eyelid rarely wrinkled with relatively few tubercles, EW 100-125 % of IOD. Top of head flat in interorbital region, skin varying from not granular, but wrinkled to strongly granular, with numerous tiny, or numerous tiny plus a few to many moderate-sized tubercles; no cranial crests; canthus rostralis angular; loreal region concave; margin of upper lip smooth to rough; upper lip distinctly flared below and posterior to orbit in both sexes; internarial area slightly concave; nostrils slitlike, protuberant, directed posterolaterally. Supratympanic fold well developed, usually consisting of series of enlarged tubercles on raised skin, extending from posterior edge of eye, but not reaching insertion of forelimb; row of raised skin, usually tuberculate, forming usually discontinuous occipital fold from posterior edge of upper eyelid to scapular region, although fold may be poorly defined in some specimens; shorter row of raised skin, usually tuberculate, extending from posterior edge of eye, curving downward above tympanum; tympanic annulus distinct and rounded in males, evident almost throughout circumference; tympanic annulus indistinct in females, usually evident anteriorly and ventrally; tympanum length about 72-85 % length of eye in males, 39-52 % in females; tympanum separated from eye by distance 26-37 % of tympanum length in males, 70-106 % in females. Choanae smaller than vomerine dentigerous processes, round, teardrop-shaped, or oval in outline, anterior edge flat and formed by anterior lateral process of vomer, not concealed by palatal shelf of maxillary arch; vomerine dentigerous processes about as long as wide, or longer than wide, oval to nearly triangular in outline; vomerine dentigerous processes posteromedial to choanae, lateral edge of dentigerous process not extending laterally to median portion of choanae; vomerine dentigerous processes separated by distance less than width of each dentigerous process, each dentigerous process bearing three to four teeth along posterior border in males, three to six teeth in females. Tongue moderate in size, longer than wide, not notched posteriorly, free posteriorly for about 25 % of its length.

Skin on dorsum of anterior part of body and limbs varying from wrinkled and not granular to strongly granular, skin with numerous tiny or numerous tiny plus a few to many moderate-sized tubercles, skin on posterior part of dorsum and on flanks with larger tubercles; skin of venter slightly wrinkled, almost smooth in many specimens, coarsely wrinkled in those specimens with strongly granular dorsa; skin below vent tuberculate; irregular series of ulnar tubercles or ulnar tubercles sometimes arranged in linear series, but not developed into fold in those specimens with strongly granular dorsa; antebrachium with numerous tiny to small tubercles; heel covered with about 20-30 small to moderate-sized tubercles; no linear series of tubercles or fold along outer edge of tarsus. Cloacal opening directed posteroventrally, slightly below upper level of thigh.

Source MNHN, Paris

Forearm moderately slender in both sexes; fingers relatively long and slender, thumb about equal to or shorter than second finger; fingers with lateral keels, fingers bearing weakly dilated discs (finger III disc 1.4-2.0 times width of phalanx just proximal to disc), all discs bearing pads, pads about as wide as long; discs on fingers III-IV as broad as or slightly broader than long; disc width on finger III 16-31 % length of tympanum in males, 26-53 % in females; discs of fingers I-II ovoid apically, those of fingers III-IV rounded; relative length of fingers in decreasing order III, IV, II, I or III, IV, II ≈ I; subarticular tubercles on fingers rounded to slightly elongate in ventral view, scarcely protuberant, flat to rounded in lateral view; supernumerary tubercles on fingers absent; palmar tubercle cordiform, about as large as or slightly larger than suboval thenar tubercle (thenar tubercle less than twice as long as wide); several small accessory palmar tubercles frequently present, males with pale nuptial pads, but without vocal slits. Hindlimbs short; heels not in contact or barely overlapping when hindlimbs flexed at right angles to axis of body, TL 52-62 % of SVL; FL 50-57 % of SVL. Inner tarsal fold absent; two metatarsal tubercles, inner about three times as long as wide, 3-4 times size of small rounded outer tubercle; no supernumerary tubercles on toes; no plantar tubercles; toes with discs and pads, disc tips broadly rounded; toes bearing well developed lateral keels and moderate webbing, webbing formula I 2 − (2 3/4 − 2 4/5) II (2 − 2^+) − (3 1/2 − 3 4/5) III (3 − 3^+) − (4^+ − 4 1/2) IV (4 1/4 − 4 3/4) − (2 3/4 − 3^+) V; disc on toe III about as broad as or slightly broader than discs on fingers III-IV; subarticular tubercles on toes slightly longer than wide, somewhat protuberant.

The color in preservative of the entire series essentially agrees with that of the holotype. Some paratypes have a broad, pale middorsal longitudinal band; some have a broad, pale dorsolateral longitudinal stripe on each side; an obscure pale interorbital bar is frequently present; some specimens have a conspicuous pale blotch below the canthus. One subadult male (MVZ 128754) has a thin, pale middorsal stripe extending from the snout to just above the vent.

Etymology. − The name *omoaensis* refers to the Sierra de Omoa, the mountain range where the species occurs.

Distribution and natural history notes. − Moderate elevations (760 to 1150 m) in the Sierra de Omoa W of San Pedro Sula, Honduras (fig. 4). The MVZ specimens of *E. omoaensis* were collected at 1150 m during the day (9 February 1974) from around a small stream flowing through a cafetal (J. F. Lynch, in litt.). We have not visited this area and can add nothing on the present status of this population. The specimens from Montaña Santa Ana were collected from an unknown elevation in August 1931, whereas the juvenile from Cañon Santa Ana was taken at about 760 m on 21 March 1923. Both of these Santa Ana localities are in an area in which the vegetation has long since been severely altered.

Remark. − The paratypes MVZ 128749-52 of *E. omoaensis* have been ventrally dissected and have their left legs missing.

Source MNHN, Paris

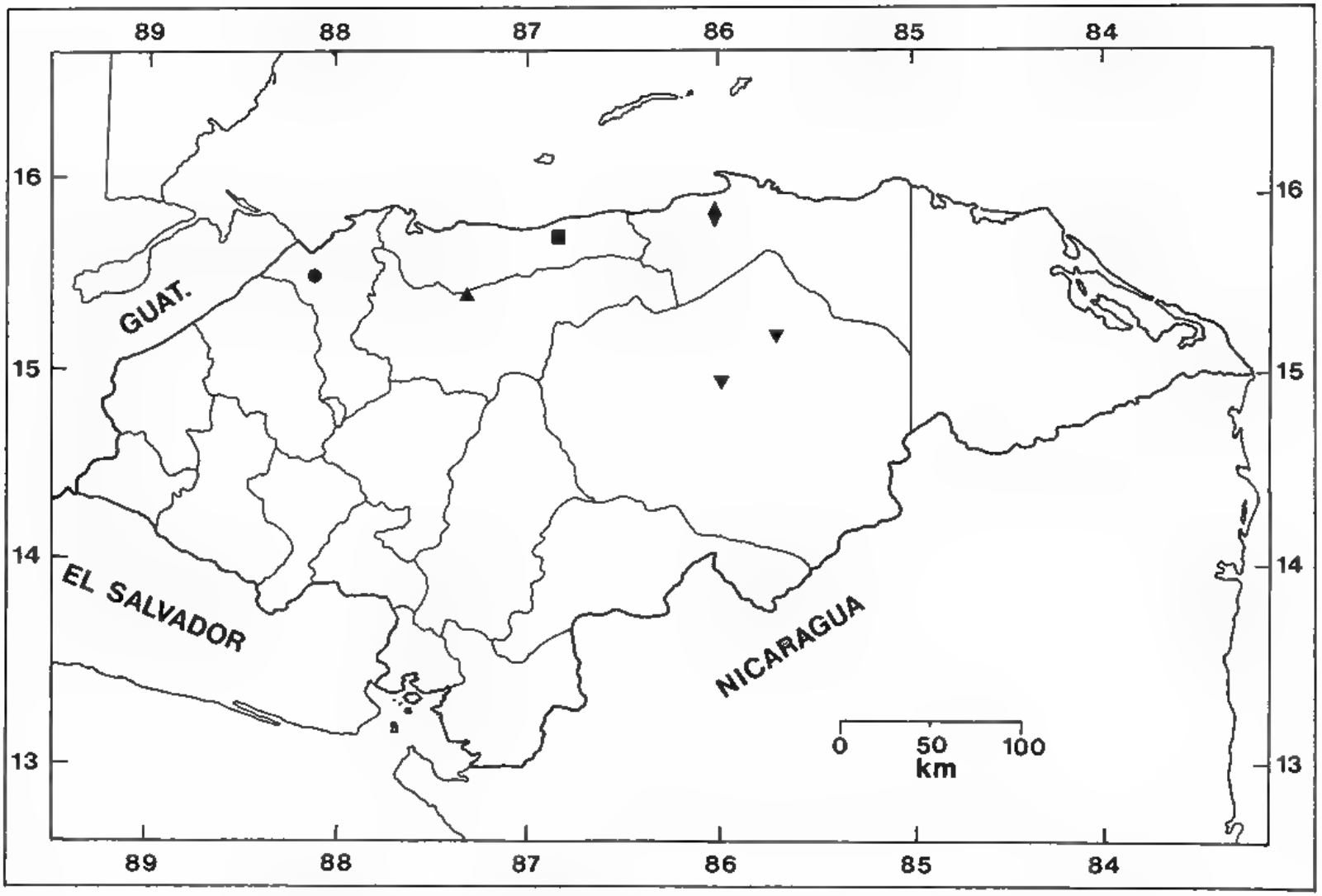

Fig. 4. – Distribution of four species of the *Eleutherodactylus milesi* group in Honduras. Circle *E omoaensis*; square: *E. fecundus* and *E saltuarius*; diamond· *E fecundus*, inverted triangles: *E epochthidius*; triangle. *E. saltuarius*. A single symbol may represent more than one locality.

Source : MNHN, Paris

Eleutherodactylus fecundus sp. nov.
(fig. 1)

Holotype. — LACM 137311, adult male, from Quebrada de Oro (15°38'N, 86°47'W), elevation 880 m, tributary of Río Viejo, south slope of Cerro Búfalo S of La Ceiba, Cordillera Nombre de Dios, Departamento de Atlántida, Honduras, 16 August 1982, James R. McCranie, Kenneth L. Williams, and Larry David Wilson. Original number LDW 6322.

Paratypes. — Nineteen specimens: KU 209084-85, 209093, 209099, 209101 and 209142, LACM 137308, USNM 497088 and 497092, all adult males, and USNM 497082-87, 497089-91 and 497093, all adult females, all from the same locality as the holotype, elevation 780 to 1260 m.

Referred specimens. — Fifty-one specimens: KU 209080, 209094, 209143 and USNM 497102, all adult males, KU 209086-92, 209095, 209098, 209100, 209102 and 209104-06, LACM 137306-07 and 137309-10, USNM 497094-96, 497098-101 and 497103-08, all adult females, and KU 206750, 209058, 209081-83, 209096, 209103, 209108 (2) and USNM 497097, all juveniles or subadults, all from the type locality, elevation 780 to 1130 m; MCZ 21293-94, both adult females, from Cordillera Nombre de Dios S of La Ceiba, Departamento de Atlántida, Honduras; USNM 497109, adult female, and USNM 497110-12, all juveniles, from Cerro Calentura, Cordillera Nombre de Dios S of Trujillo, Departamento de Colón, Honduras, elevation 460 m.

Diagnosis. — (1) Skin of dorsum not granular, but wrinkled, with tiny to small tubercles; skin of venter slightly wrinkled, almost smooth; (2) male tympanic annulus indistinct (5 out of 10 specimens in type series), very indistinct (2 out of 10), or hidden (3 out of 10); female tympanic annulus indistinct (4 out of 10 specimens in type series), very indistinct (2 out of 10), or hidden (4 out of 10); (3) snout nearly rounded to rounded in dorsal view, rounded to nearly vertical (with rounded upper end) in profile; (4) upper eyelid 103-133 % interorbital distance, wrinkled, with numerous tiny and about 10-20 small to large tubercles, no cranial crests; (5) vomerine dentigerous processes oval or somewhat triangular in outline; (6) vocal slits and pale nuptial pads present in males; (7) first finger shorter than second or first and second fingers about equal in length; fingers bearing moderately well developed pads; (8) fingers bearing lateral keels; (9) ulnar tubercles absent or indistinct; (10) heel bearing small tubercles; no linear series of tubercles along outer edge of tarsus; no inner tarsal fold; (11) inner metatarsal tubercle elongate, 3-4 times size of small rounded outer metatarsal tubercle; no plantar tubercles; (12) toes bearing well developed lateral keel, weakly developed fringes occasionally present on toe IV of large females; webbing moderate (fig. 3) for *milesi* group (modal formula I 2 — 2 4/5 II 2 — 3 3/4 III 3 — 4 1/4 IV 4 1/4 — 2 3/4 V); discs of toes III-IV about as broad as or slightly broader than those on fingers III-IV; (13) dorsum of head and body medium brown to dark brown, some specimens with broad, pale dorsolateral longitudinal stripe on each side, thin, pale middorsal stripe rarely present from level just posterior to eyes to above vent; para-anal pale bars or spots well defined, indistinct, or absent; belly and venter of thigh cream colored, lightly to moderately flecked with brown, chin and throat more heavily flecked, especially in some males; (14) adults moderate-sized relative to other members of

Source MNHN, Paris

E. milesi group, 10 males 21.1-23 5 (x = 22.2) mm SVL, 10 females 29.8-37.3 (x = 33.5) mm SVL.

Comparisons. – *Eleutherodactylus fecundus* is most similar to *E. milesi*, but differs in tympanum condition (annulus indistinct, very indistinct, or hidden in male and female *fecundus* versus distinct in male and indistinct in female *milesi*) and amount of webbing on toes III-V (see above and tab. 2). *Eleutherodactylus fecundus* differs from *E. omoaensis* (the apparent closest relative of *E. milesi*) in the same tympanic annulus condition as it does from *E. milesi*. These two species also differ in upper lip condition (not flared in *fecundus* versus flared in *omoaensis*), adult male size (see above and tab. 1), male tympanum size (length about 36-49 % length of eye in *fecundus* versus 72-85 % in *omoaensis*), and male vocal slit condition (present in *fecundus* versus absent in *omoaensis*). *Eleutherodactylus fecundus* can be distinguished from the remaining *E. milesi* group members by the following combination of characters: moderate adult size; indistinct, very indistinct, or hidden tympanic annulus condition in both males and females; moderate toe webbing; and toes with well developed lateral keels.

Measurements of holotype (mm). – SVL 22.1; HL 9.4; HW 9.5; EL 3.2; E-N 1.9; TL 12.9; FL 12.0; EW 2.9, IOD 2.6; F3 0.4.

Colors of holotype in preservative. – Dorsum of head and body medium brown, most larger tubercles with pale gray tips; dark crossbars on limbs well defined; iris gray; pale interorbital bar well defined; dark bars on upper lip well defined; posterior of thigh heavily flecked with brown, with tiny to small pale brown spots; pale para-anal bars fairly well defined; belly and venter of thigh cream colored, moderately flecked with brown, chin and throat more heavily flecked; palmar surface cream colored, moderately flecked with brown; plantar surface cream colored, more heavily flecked with brown than palmar surface.

Description. – The following measurements and proportions are based on the entire type series of 10 adult males and 10 adult females. Head nearly as wide as long to slightly wider than long (width 85-105 % of length); HW 37-46 % of SVL; HL 40-46 % of SVL in males, 38-42 % in females; snout nearly rounded to rounded in dorsal view, rounded to nearly vertical (with rounded upper end) in profile; E-N 7-12 % of SVL; upper eyelid wrinkled with numerous tiny and about 10-20 small to large tubercles, EW 103-133 % of IOD. Top of head flat in interorbital region, skin not granular, but wrinkled, with numerous tiny, or numerous tiny plus scattered small tubercles; no cranial crests; canthus rostralis angular; loreal region concave; margin of upper lip smooth, or smooth with scattered tiny tubercles; upper lip not flared; internarial area slightly concave; nostrils slitlike, protuberant, directed posterolaterally. Supratympanic fold usually well developed, consisting of raised skin, with or without tubercles, extending from posterior edge of eye, but not reaching insertion of forelimb; row of raised skin, with or without tubercles, forming discontinuous occipital fold from posterior edge of upper eyelid to scapular region; shorter row of raised skin, with or without tubercles, extending from posterior edge of eye, curving downward above tympanum; tympanic annulus indistinct (usually evident anteriorly and ventrally), very indistinct (usually evident anteroventrally), or hidden in males and females; tympanum length about 36-49 % length of eye in males (n = 5), 34-43 % in females (n = 4); tympanum separated from eye by distance 56-67 % of tympanum length in males, 81-85 %

Source MNHN, Paris

in females. Choanae slightly smaller than vomerine dentigerous processes in males, much smaller than them in females, round, teardrop-shaped, or oval in outline, anterior edge flat and formed by anterior lateral process of vomer, not concealed by palatal shelf of maxillary arch; vomerine dentigerous processes about as long as wide, or longer than wide, oval to nearly triangular in outline; vomerine dentigerous processes posteromedial to choanae, lateral edge of dentigerous process not extending laterally to median portion of choanae; vomerine dentigerous processes separated by distance about equal to or less than width of each dentigerous process; each dentigerous process bearing three to five teeth along posterior border in males, five to eight teeth in females. Tongue moderate in size, longer than wide, not notched posteriorly, free posteriorly for about 25-35 % of its length.

Skin on dorsum of anterior part of body and limbs not granular, but wrinkled, skin with numerous tiny or numerous tiny plus scattered small tubercles; skin on posterior part of dorsum and flanks with larger tubercles; skin of venter slightly wrinkled, almost smooth; skin below vent tuberculate; ulnar tubercles absent, or irregular series of ulnar tubercles present, or ulnar tubercles occasionally arranged in linear series, but not developed into fold; antebrachium smooth or wrinkled, occasionally few small tubercles may be present; heel covered with about 15-30 small tubercles; no linear series of tubercles or fold along outer edge of tarsus. Cloacal opening directed posteroventrally, slightly below upper level of thigh.

Forearm moderately slender in both sexes; fingers relatively long and slender, thumb about equal to or slightly shorter than second finger; fingers with lateral keels; fingers bearing weakly dilated discs (finger III disc 1.3-1.8 times width of phalanx just proximal to disc), all discs bearing pads, pads about as wide as long; discs on fingers III-IV slightly broader than long; disc width on finger III 21-42 % length of tympanum in males (n = 5), 31-38 % in females (n = 4); discs of fingers I-II ovoid apically, those of fingers III-IV rounded; relative length of fingers in decreasing order III, IV, II, I or III, IV, II ≈ I; subarticular tubercles on fingers rounded to slightly elongate in ventral view, scarcely protuberant, flat to rounded in lateral view; supernumerary tubercles on fingers absent; palmar tubercle cordiform or oval, about as large as or slightly larger than suboval thenar tubercle (thenar tubercle less than twice as long as wide); several small accessory palmar tubercles frequently present; males with pale nuptial pads and vocal slits. Hindlimbs short; heels not in contact or barely overlapping when hindlimbs flexed at right angles to axis of body; TL 49-61 % of SVL; FL 44-54 % of SVL Inner tarsal fold absent; two metatarsal tubercles, inner tubercle about three times as long as wide, 3-4 times size of small rounded outer tubercle; no supernumerary tubercles on toes; no plantar tubercles; toes with discs and pads, disc tips broadly rounded; toes bearing well developed lateral keels (large females occasionally with weakly developed fringes on toe IV) and moderate webbing, webbing formula I (2 − 2^+) 2 4/5 II 2 (3 1/2 3 4/5) III 3 (4 4 1/2) IV (4^+ − 4 3/4) − (2 1/2 − 2 4/5) V, disc on toe III about as broad as or slightly broader than discs on fingers III-IV; subarticular tubercles on toes slightly longer than wide, somewhat protuberant.

Color in life of four adult females from the Quebrada de Oro region. − USNM 497095. dorsum dark chocolate brown, broad, irregular ocher dorsolateral stripe extending from posterior of eye to groin; ocher blotch present below canthus; ocher blotch on upper

Source MNHN, Paris

arm continuous with dorsolateral stripe; dorsum of thigh ocher with brown crossbars; dorsum of tibia banded brown and dark brown; para-anal spots pale orange; chin and chest gray; belly and venter of thigh pale lemon yellow, flecked with brown, iris black with dense gold flecking USNM 497096· dorsum very dark chocolate brown; broad, dark red dorsolateral stripe extending from posterior of eye to groin, dorsal surfaces of limbs very dark chocolate brown; posterior of thigh dark brown; chin and chest dark chocolate brown; belly and venter of thigh lemon yellow, flecked with brown; iris black with dense gold flecking. KU 209100: dorsum dirty dark greenish gray, pale red to rust red spot on rostrum, at forelimb insertion, and on heel; chin and chest gray; belly and venter of thigh lemon yellow with some brown flecking; iris pale copper. USNM 497103: dorsum brown, larger tubercles with slightly darker brown tips; thin, orange middorsal stripe extending from level just posterior to eyes to vent; dorsal surfaces of limbs dark brown; toe and finger discs white dorsally; flanks dark brown; chin and chest pale brown; belly and venter of thigh yellow with brown suffusion.

The color in preservative of the entire series essentially agrees with that of the holotype, except that many specimens have darker brown dorsal surfaces. Some specimens have a broad, pale dorsolateral longitudinal stripe on each side; occasional specimens have a thin, pale middorsal stripe extending from level just posterior to eye to vent; the pale interorbital bar varies from well defined to obscure; some specimens have a pale blotch below the canthus; dark bars are present on the upper lip in most specimens; the pale para-anal bars or spots vary from well developed to indistinct or absent.

Etymology. – The name *fecundus* is Latin, meaning fertile or fruitful. The name is used in reference to the Cordillera Nombre de Dios, the mountain range in which this species occurs, being fertile or fruitful grounds for the discovery of new species of amphibians and reptiles.

Distribution and natural history notes. – Low and moderate elevations (460 to 1260 m) of the Cordillera Nombre de Dios south of La Ceiba and Trujillo (fig. 4), Honduras. The series from the Quebrada de Oro region was collected during May to August alongside streams between 780 to 1260 m in the Premontane Wet Forest formation of Holdridge (1967). Adults were usually active at night, while juveniles and subadults were active both at night and during the day. No specimens of *E. fecundus* were seen during 10 days and nights of collecting in the Quebrada de Oro region in February 1995 (see *Introduction*), although other Honduran members of the *E. milesi* group (*E. omoaensis*, *E. stadelmani*, and *E.* sp. nov.) have been collected while active during this month. The specimens from near Trujillo were collected in June alongside a stream at 460 m in the Lowland Moist Forest formation of Holdridge (1967). Data accompanying the MCZ specimens indicate that they were collected in April.

Eleutherodactylus saltuarius sp. nov.
(fig. 1)

Holotype. – USNM 497115, adult male, from south slope of Cerro Búfalo (15°39′N, 86°48′W), elevation 1550 m, Cordillera Nombre de Dios, Departamento de Atlántida,

Source MNHN, Paris

Honduras, 18 February 1995, James R. McCranie and John C. Rindfleish. Original number LDW 10432.

Paratypes. – Four specimens: USNM 497117, an adult male, USNM 497119, a subadult male, and USNM 497118, a subadult female, all from 2.5 airline km NNE La Fortuna, Cordillera Nombre de Dios, Departamento de Yoro, Honduras; USNM 497116, a subadult male from the type locality.

Diagnosis. – (1) Skin of dorsum not granular, but wrinkled, with tiny to small tubercles; skin of venter slightly wrinkled, almost smooth; (2) male tympanic annulus distinct or indistinct; tympanic annulus in one subadult female very indistinct; (3) snout nearly rounded in dorsal view, nearly vertical (with rounded upper end) in profile; (4) upper eyelid 100-120 % interorbital distance (including subadult female), wrinkled, with scattered small to moderate-sized tubercles, no cranial crests, (5) vomerine dentigerous processes oval to nearly triangular in outline; (6) vocal slits and pale nuptial pads present in males, (7) first finger shorter than second; fingers bearing moderately well developed pads; (8) fingers bearing lateral keels; (9) ulnar tubercles absent; (10) heel mostly smooth or bearing small tubercles; no linear series of tubercles along outer edge of tarsus; no inner tarsal fold; (11) inner metatarsal tubercle oval, 3-4 times size of small rounded outer metatarsal tubercle; no plantar tubercles; (12) toes bearing well developed lateral keel, webbing minimal (fig. 3) for *E. milesi* group (modal formula I – II 2^+ – 3 4/5 III 3^+ – 4 1/2 IV 4 1/2 – 3^- V); discs of toes III-IV about as broad as those on fingers III-IV; (13) (also includes all subadults) dorsum of head and body dark brown or grayish brown, usually with darker colored spotting on back; para-anal pale bars well defined to indistinct; belly and venter of thigh cream colored, moderately flecked with brown, with some flecking on belly usually coalesced into scattered spots, chin and throat more heavily flecked, becoming uniformly brown in some males; (14) adults small relative to other members of *E. milesi* group, two males 19.6-22.4 (x = 21.0) mm SVL, one subadult female 17.8 mm SVL.

Comparisons – Adult males of *E. saltuarius* are somewhat similar in size to those of *E. fecundus* and *E. milesi*. *Eleutherodactylus saltuarius* differs from *E. fecundus* in amount of toe webbing (see above and tab. 2), ventral coloration in preservative (some flecking on belly usually coalesced into spots in *saltuarius* versus belly flecking more or less evenly distributed in *fecundus*) and in life (belly and venter of thigh Clay Color [color 26 in Smithe, 1975] with numerous spots that were either dark brown or white in *saltuarius* versus yellow with brown flecking in *fecundus*), and habitat (forest floor well away from streams in *saltuarius* versus streamside in *fecundus*). *Eleutherodactylus saltuarius* can be distinguished from *E. milesi* by tympanum condition (annulus distinct or indistinct in male and very indistinct in female *saltuarius* versus distinct in male and indistinct in female *milesi*), male tympanum size (length 35-46 % length of eye in *saltuarius* versus 47-68 % in *milesi*), ventral coloration in life (belly and venter of thigh Clay Color with numerous spots that were either dark brown or white in *saltuarius* versus belly yellow with brown flecking and venter of thigh yellowish orange with brown flecks in *milesi*), and habitat (forest floor well away from streams in *saltuarius* versus streamside in *milesi*). Streamside habitats at the two known localities for *E. saltuarius* are occupied by either *E. cruzi* (Cerro Búfalo) or *E. stadelmani* (NNE of La Fortuna). Both of these species have considerably larger males (to

Source MNHN, Paris

33.2 mm SVL in *cruzi*, 33.1 in *stadelmani*, 22.4 in *saltuarius*), fleshy toe fringes (lateral keels in *saltuarius*), more toe webbing (see above and tab 2), and usually hidden tympana in males (distinct or indistinct in male *saltuarius*). Juvenile or subadult *E. stadelmani* (USNM 497178: 20.3 mm SVL; USNM 497179: 20.4 mm SVL; USNM 497186: 15.2 mm SVL) from streamside habitats at the La Fortuna locality are easily distinguished from *E. saltuarius* by having well developed toe webbing and fringes. Juvenile or subadult *E. cruzi* are unknown, but presumably have toe fringes and webbing similar to the conditions found in immature *E. stadelmani*.

Measurements of holotype (mm). – SVL 22.4, HL 9.0; HW 8.8, EL 2.9; E-N 2.0; TM 1.0, E-T 0 6; TL 13.7; FL 12.7; EW 2.3; IOD 2.3; F3 0.3.

Colors of holotype in life. – Dorsum Clay Color with larger tubercles on back reddish brown; dorsal and anterior surfaces of limbs Clay Color with darker brown crossbars; posterior of thigh Clay Color with dirty white mottling; belly and venter of thigh Clay Color with numerous spots that were either dark brown or white; chin and throat dark brown; iris pale brown with dark brown reticulations

Colors of holotype in preservative – Dorsum of head and body grayish brown with darker brown spotting on back; darker crossbars on limbs well defined; iris gray; pale interorbital bar indistinct; dark bars on upper lip distinct; posterior of thigh heavily flecked with brown, with cream colored spots and mottling; para-anal pale bars well defined, belly and venter of thigh cream colored, moderately flecked with brown, some flecking on belly coalesced into scattered spots; chin and throat uniformly brown.

Description. – The following measurements and proportions are based on two adult males and one subadult female. Head longer than wide (width 95-98 % of length); HW 39-43 % of SVL; HL 40-41 % of SVL in males, 45 % in subadult female; snout nearly rounded in dorsal view, nearly vertical (with rounded upper end) in profile; E-N 9 % of SVL; upper eyelid wrinkled, with scattered small to moderate-sized tubercles, EW 100-120 % of IOD. Top of head flat in interorbital region, skin not granular, but wrinkled, with numerous tiny, or numerous tiny plus a few small tubercles; no cranial crests; canthus rostralis angular; loreal region concave; margin of upper lip smooth to rough; upper lip not flared; internarial area slightly concave; nostrils slitlike, protuberant, directed posterolaterally. Supratympanic fold not well developed, consisting of raised skin, with or without tubercles, extending from posterior edge of eye, but not reaching insertion of forelimb; row of raised skin, with or without tubercles, forming obscure, discontinuous occipital fold from posterior edge of upper eyelid to scapular region; shorter row of raised skin, with or without tubercles, extending from posterior edge of eyelid, curving downward above tympanum; tympanic annulus distinct and rounded or indistinct (annulus evident anteriorly and ventrally) in males and very indistinct (annulus evident anteriorly) in one subadult female; tympanum length about 35-46 % length of eye in males; tympanum separated from eye by distance 46-60 % of tympanum length in males. Choanae smaller than vomerine dentigerous processes, round, teardrop-shaped, or oval in outline, anterior edge flat and formed by anterior lateral process of vomer, not concealed by palatal shelf of maxillary arch; vomerine dentigerous processes about as long as wide, or longer than wide, oval to nearly triangular in outline; vomerine dentigerous processes posteromedial to choanae, lateral edge of dentigerous process not extending laterally to median portion

Source MNHN, Paris

of choanae; vomerine dentigerous processes separated by distance less than width of each dentigerous process, each dentigerous process bearing three to four teeth along posterior border in males. Tongue moderate in size, longer than wide, not notched posteriorly, free posteriorly for nearly 50 % of its length.

Skin on dorsum of anterior part of body and limbs not granular, but wrinkled, skin with numerous tiny or numerous tiny plus a few small tubercles; skin on posterior part of dorsum and flanks with a few enlarged tubercles; skin of venter slightly wrinkled, almost smooth; skin below vent tuberculate, no ulnar tubercles, antebrachium smooth, heel mostly smooth or with up to about 10-15 small tubercles; no linear series of tubercles or fold along outer edge of tarsus. Cloacal opening directed posteroventrally, slightly below upper level of thigh.

Forearm moderately slender in both sexes; fingers relatively long and slender, thumb shorter than second finger; fingers with lateral keels; fingers bearing weakly dilated discs (finger III disc 1.5 times width of phalanx just proximal to disc), all discs bearing pads, pads almost as wide as long; discs on fingers III-IV about as broad as long; disc width on finger III 23-30 % length of tympanum in males; discs of fingers I-II ovoid apically, those of fingers III-IV rounded; relative length of fingers in decreasing order III, IV, II, I; subarticular tubercles on fingers rounded to slightly elongate in ventral view, scarcely protuberant, flat to rounded in lateral view, supernumerary tubercles on fingers absent; palmar tubercle cordiform, about as large as oval thenar tubercle (thenar tubercle roughly twice as long as wide), several small accessory palmar tubercles present; males with pale nuptial pads and vocal slits Hindlimbs short; heels slightly overlapping when hindlimbs flexed at right angles to axis of body; TL 61-64 % of SVL; FL 55-57 % of SVL. Inner tarsal fold absent; two metatarsal tubercles, inner tubercle about two times as long as wide, 3-4 times size of small rounded outer tubercle; no supernumerary tubercles on toes; no plantar tubercles, toes with discs and pads, disc tips broadly rounded, toes bearing well developed lateral keels and minimal webbing, webbing formula I (absent or very basal) II $2^{+} - 3\ 4/5$ III $(3 - 3^{+}) - (4\ 1/2 - 4\ 3/4)$ IV $(4\ 1/2 - 4\ 3/4) - (3^{-} - 3)$ V; disc on toe III about as broad as discs on fingers III-IV; subarticular tubercles on toes slightly longer than wide, somewhat protuberant.

Color in life of USNM 497116 was recorded as being very similar to that of the holotype. The color in preservative of the paratypes is similar to that of the holotype, except some details: some specimens have dark brown dorsa, the pale interorbital bar is sometimes well defined, a large pale spot occurs posteromedially to the eyes in two specimens, the pale para-anal bars may be indistinct, and one specimen lacks the brown spots on the belly.

Etymology. — The name *saltuarius* is a Latin word meaning "keeper of the sacred forest of Virtue". The name is used in reference to the occurrence of this species in forested habitats well away from streams.

Distribution and natural history notes. — Intermediate elevations (1550 to 1800 m) from two localities in the Lower Montane Wet Forest formation of HOLDRIDGE (1967) in the Cordillera Nombre de Dios of north-central Honduras (fig. 4). Specimens were collected while active during the day on the forest floor in February and August. The forest at both localities for the species was in a primary state with a closed canopy when the specimens

Source MNHN, Paris

were collected. However, in August 1995, four years after we collected this species NNE of La Fortuna, we found these forests to be in a less than pristine condition. Tracts of forest had been clear cut and burned to make way for crops. Probably not coincidently, no specimens of *E. saltuarius* were seen at that time, although a concerted effort was made to collect more specimens.

Remarks. – A subadult male *E. saltuarius* (USNM 497116), with a SVL of 14.9 mm, has a single vocal slit on the right side and the nuptial pads beginning to develop.

Eleutherodactylus epochthidius sp. nov.

Holotype. – ROM 18109, adult female, from Río Seco (14°55′N, 85°56′W), elevation 1050 m, tributary of Río Guayape N of Catacamas, Sierra de Agalta, Departamento de Olancho, Honduras, 8 August 1986, James R. McCranie, Kenneth L. Williams and Larry David Wilson. Original number LDW 8297.

Paratypes. – Ten specimens: ROM 18110 and 18113, both adult males, and ROM 18112, adult female, all from the same locality as the holotype, elevation 1000 to 1060 m; ROM 18100-01 and 18103-05, all adult males, and ROM 18099 and 18102, both adult females, all from between ríos Catacamas and Seco, Sierra de Agalta N of Catacamas, Departamento de Olancho, Honduras, elevation 1450 m.

Referred specimens. – Five specimens: ROM 18108, subadult male, and ROM 18111, juvenile, both from the type locality, elevation 1000-1050 m; ROM 18106-07, both juveniles, from between ríos Catacamas and Seco, Sierra de Agalta N of Catacamas, Departamento de Olancho, Honduras, elevation 1450 m, KU 209059, subadult female, from Montaña de Malacate ca. 10 airline km NW Dulce Nombre de Culmí, Sierra de Agalta, Departamento de Olancho, Honduras, elevation 760 m.

Diagnosis. – (1) Skin of dorsum not granular, but wrinkled, with tiny to small tubercles; skin of venter slightly wrinkled, almost smooth; (2) male tympanic annulus indistinct (2 out of 7 specimens in type series), very indistinct (4 out of 7), or hidden (1 out of 7); female tympanic annulus indistinct (1 out of 4 specimens in type series) or very indistinct (3 out of 4); (3) snout nearly rounded to rounded in dorsal view, rounded to nearly vertical (with rounded upper end) in profile; (4) upper eyelid 100-121 % interorbital distance, wrinkled, with scattered small to moderate-sized tubercles; no cranial crests; (5) vomerine dentigerous processes oval or somewhat triangular in outline; (6) vocal slits and pale nuptial pads present in males; (7) first finger shorter than second or first and second fingers about equal in length; fingers bearing moderately well developed pads; (8) fingers bearing lateral keels; (9) ulnar tubercles absent or indistinct; (10) heel bearing small tubercles; no linear series of tubercles along outer edge of tarsus; no inner tarsal fold; (11) inner metatarsal tubercle elongate, 3-4 times size of small rounded outer metatarsal tubercle; no plantar tubercles; (12) toes III-IV or toe IV of males bearing distinct or weak lateral fleshy fringes that fold ventrally, toes III-IV of females bearing distinct lateral fleshy fringes that fold ventrally, remaining toes bearing well developed lateral keels; webbing moderate for *milesi* group (modal formula I 2 – 2 3/4 II 2 – 3 1/2 III 3 – 4 1/4 IV 4

Source MNHN, Paris

1/4 – 2 3/4 V); disc of toes III-IV about as broad as or slightly broader than those on fingers III-IV; (13) dorsum of head and body pale brown to dark brown, frequently with darker brown blotches or hourglass figure on back; para-anal pale bars or spots well defined, indistinct, or absent; belly and venter of thigh cream colored, heavily flecked with brown; chin, throat, and chest with dense brown flecking surrounding pale "spots"; (14) adults moderate-sized relative to other members of *E. milesi* group, seven males 20.9-26.9 (x = 24.4) mm SVL, four females 33.1-36.7 (x = 35.1) mm SVL.

Comparisons. – *Eleutherodactylus epochthidius* approaches *E. chrysozetetes*, *E. stadelmani* and *E. cruzi* by having fleshy fringes on toes III-IV (females and some males) or on toe IV only (remaining males) (fleshy fringes present on toes II-IV in *chrysozetetes*, *stadelmani*, and *cruzi*). However, *E. epochthidius* differs from these three species by having less toe webbing (see above and tab. 2), smaller male size (see above and tab. 1), and tympanum condition (usually very indistinct, occasionally indistinct, or rarely hidden versus hidden in *chrysozetetes* and usually hidden or rarely very indistinct in *stadelmani* and *cruzi*) *Eleutherodactylus epochthidius* further differs from *E. cruzi* by lacking a pale middorsal stripe (present in *cruzi*) *Eleutherodactylus epochthidius* is similar to *E. fecundus* in adult size, amount of toe webbing and tympanum condition, but differs from that species by having distinct to rather weak fleshy toe fringes that fold ventrally on toes III-IV (females and some males) or on toe IV only (remaining males), whereas lateral keels are almost always present on toes III-IV in *fecundus* (occasional large females of *fecundus* have weakly infolded fringes on toe IV). *Eleutherodactylus epochthidius* further differs from *E. fecundus* in ventral coloration (usually dense brown flecking on the chin, throat and chest surrounding pale "spots" versus usually moderate flecking that is more or less evenly distributed in *fecundus*) *Eleutherodactylus epochthidius* can be distinguished from the remaining *E. milesi* group members by the following combination of characters: moderate adult size; usually very indistinct, occasionally indistinct, or rarely hidden tympanic annulus condition; moderate toe webbing; toes III-IV or toe IV with distinct to rather weak fleshy fringes; upper lip not flared, and male vocal slits present.

Measurements of holotype (mm). – SVL 35.4; HL 15.3; HW 15.4; EL 5 2; E-N 3 1; TL 22.0; FL 20.5; EW 3.1; IOD 3.1; F3 0.8.

Colors of holotype in life. – Dorsum of body with dark chocolate brown middorsal hourglass figure, rest of dorsum of body brick red; dorsal surfaces of limbs mottled and banded with dark chocolate brown and brick red; chin and throat dark brown with several white spots; chest and anterior portion of belly mottled dark brown and white; posterior portion of belly and ventral surface of thighs pale yellow, rather heavily flecked with brown; palms and soles dark brown; iris dark metallic green.

Colors of holotype in preservative. – Dorsum of head and body pale brown with darker brown hourglass figure on back, most larger tubercles with pale gray tips; dark crossbars on limbs fairly well defined; iris gray; dark bars on upper lip well defined; posterior of thigh heavily flecked with brown, with tiny to small pale brown spots, pale para-anal bars fairly well defined; belly and venter of thigh cream colored, heavily flecked with dark brown; chin, throat, and chest with dense dark brown flecking surrounding pale "spots"; palmar and plantar surfaces densely flecked with dark brown.

Source MNHN, Paris

Description. – The following measurements and proportions are based on the entire type series of seven adult males and four adult females. Head nearly as wide as long in males (width 95-98 % of length) and slightly wider than long in females (width 101-102 % of length); HW 40-46 % of SVL; HL 41-48 % of SVL; snout nearly rounded to rounded in dorsal view, rounded to nearly vertical (with rounded upper end) in profile; E-N 8-10 % of SVL; upper eyelid wrinkled with numerous tiny and a few small to moderate-sized tubercles, EW 100-121 % of IOD. Top of head flat in interorbital region, skin not granular, but wrinkled, with numerous tiny, or numerous tiny plus scattered small tubercles; no cranial crests; canthus rostralis angular; loreal region concave; margin of upper lip smooth, or smooth with scattered tiny tubercles; upper lip not flared; internarial area slightly concave; nostrils slitlike, protuberant, directed posterolaterally. Supratympanic fold usually well developed, consisting of raised skin, with or without tubercles, extending from posterior edge of eye, but not reaching insertion of forelimb; row of raised skin, with or without tubercles, forming discontinuous occipital fold from posterior edge of upper eyelid to scapular region; tympanic annulus usually very indistinct (annulus usually evident anteroventrally), occasionally indistinct (annulus usually evident anteriorly and ventrally), or rarely hidden; tympanum length about 34-39 % length of eye in males (n = 2), 29 % in one female; tympanum separated from eye by distance 79-92 % of tympanum length in two males, 160 % in one female. Choanae slightly smaller than vomerine dentigerous processes in males, much smaller than vomerine dentigerous processes in females, round, teardrop-shaped, or oval in outline, anterior edge flat and formed by anterior lateral process of vomer, not concealed by palatal shelf of maxillary arch; vomerine dentigerous processes about as long as wide, or longer than wide, oval to nearly triangular in outline, vomerine dentigerous processes posteromedial to choanae, lateral edge of dentigerous process not extending laterally to median portion of choanae; vomerine dentigerous processes separated by distance about equal to or less than width of each dentigerous process; each dentigerous process bearing three to four teeth along posterior border in males, five to seven teeth in females. Tongue moderate in size, longer than wide, not notched posteriorly, free posteriorly for about 25-35% of its length.

Skin on dorsum of anterior part of body and limbs not granular, but wrinkled, skin with numerous tiny or numerous tiny plus scattered small tubercles; skin on posterior part of dorsum and flanks with larger tubercles; skin of venter slightly wrinkled, almost smooth; skin below vent tuberculate; ulnar tubercles absent, or irregular series of ulnar tubercles present, or ulnar tubercles occasionally arranged in linear series, but not developed into fold; antebrachium smooth or wrinkled, occasionally with few small tubercles; heel covered with about 10-30 small tubercles; no linear series of tubercles or fold along outer edge of tarsus. Cloacal opening directed posteroventrally, slightly below upper level of thigh.

Forearm moderately slender in both sexes; fingers relatively long and slender, thumb about equal to or slightly shorter than second finger; fingers with lateral keels; fingers bearing weakly dilated discs (finger III disc 1.6-2.0 times width of phalanx just proximal to disc), all discs bearing pads, pads about as wide as long; discs on fingers III-IV slightly broader than long; disc width on finger III 46-57 % length of tympanum in males (n = 2), 53 % in one female; discs of fingers I-II ovoid apically, those of fingers III-IV rounded;

Source MNHN, Paris

relative length of fingers in decreasing order III, IV, II, I or III, IV, II ≈ I; subarticular tubercles on fingers rounded to slightly elongate in ventral view, scarcely protuberant, flat to rounded in lateral view; supernumerary tubercles on fingers absent; palmar tubercle cordiform or oval, about as large as or slightly larger than suboval thenar tubercle (thenar tubercle less than twice as long as wide), several small accessory palmar tubercles frequently present; males with pale nuptial pads and vocal slits. Hindlimbs short; heels not in contact or barely overlapping when hindlimbs flexed at right angles to axis of body; TL 54-62 % of SVL; FL 51-58 % of SVL. Inner tarsal fold absent; two metatarsal tubercles, inner tubercle about three times as long as wide, 3-4 times size of small rounded outer tubercle; no supernumerary tubercles on toes; no plantar tubercles; toes with discs and pads, disc tips broadly rounded; toes III-IV or toe IV of males bearing distinct to rather weak lateral fleshy fringes that fold ventrally, toes III-IV of females bearing distinct lateral fleshy fringes that fold ventrally, remaining toes bearing well developed lateral keels; toes with moderate webbing, webbing formula I 2 – (2 1/2 – 2 3/4) II 2 – (3 1/2 – 3 3/4) III 3 – 4 1/4 IV (4^+ – 4 1/4) – (2^+ – 2 4/5) V; disc on toe III about as broad as or slightly broader than discs on fingers III-IV; subarticular tubercles on toes slightly longer than wide, somewhat protuberant.

Color in life of an adult female (ROM 18112) was as follows: dorsum of body and head brown with dark outlined pale interorbital bar, bar preceded by and followed by tan blotches; dorsal surfaces of limbs brown with dark brown crossbars; groin golden yellow; chin brown with white punctations; chest mottled brown and white; belly and venter of thigh dirty yellow; palms and soles brown; iris bronze with rust copper band in pupil.

The color in preservative of the type series may be described as follows: dorsum of head and body pale brown to dark brown, frequently with darker brown blotches or hourglass figure on back; pale interorbital bar varying from well defined to obscure; dark bars present on upper lip in most specimens; para-anal pale bars or spots well defined, indistinct, or absent; belly and venter of thigh cream colored, heavily flecked with dark brown, chin, throat, and chest densely flecked with dark brown, flecking surrounding pale "spots" on many specimens, the pale "spots" extending onto belly in occasional specimens. A single subadult female (KU 209059) has much paler ventral surfaces than the remaining specimens, including the other subadult specimen and the juveniles

Etymology – The specific name *epochthidius* is formed from the Greek word *epochthidios*, which means on or of the mountains. The name alludes to the montane habitat of this species.

Distribution and natural history notes. – Moderate elevations (760 to 1450 m) in the Premontane Wet Forest formation of HOLDRIDGE (1967) of the Sierra de Agalta north of Catacamas and northwest of Dulce Nombre de Culmí (fig. 4), Honduras. The series from between the ríos Catacamas and Seco was taken in about 30 min of collecting along a small stream just before midday on 5 August 1986. The Río Seco series was collected both during the day and at night along a large stream on 8-9 August 1986. The Montaña de Malacate specimen was collected along a small stream just before midday on 11 June 1980.

Source MNHN, Paris

Key to the Honduran species in the *E. milesi* group

1. Toes with lateral fleshy fringes 2

   Toes with well developed lateral keel, but without fleshy fringes (toe IV with weak fleshy fringes in some large female *E. fecundus*) 5

2. Toes extensively webbed, modal formula I 1 1/3 – 2 II 1 1/3 – 2 1/2 III 2 – 3 1/3 IV 3 1/3 – 2 V; males to 41 mm SVL (moderate elevations of central part of Cordillera Nombre de Dios) ..... *E. chrysozetetes*

   Toes moderately webbed, modal formula I 2 – 2 3/4 II 2 – 3 1/2 III 3^- – 4 IV 4 – 2 1/2 V or I 2 – 2 3/4 II 2 – 3 1/2 III 3 – 4 1/4 IV 4 1/4 – 2 3/4 V; males less than 34 mm SVL 3

3. Toes III-IV or only toe IV (some males) with lateral fleshy fringes; webbing on toes III-V slightly reduced, modal formula III 3 – 4 1/4 IV 4 1/4 – 2 3/4 V; males 20.9-26.9 mm SVL (moderate elevations of Sierra de Agalta)... *E. epochthidius*

   Toes II-IV with lateral fleshy fringes; increased webbing on toes III-V, modal formula III 3^- – 4 IV 4 – 2 1/2 V; males 27.0-33.2 mm SVL 4

4. Thin, pale middorsal stripe extending from tip of snout to above vent (intermediate elevations of central part of Cordillera Nombre de Dios) ..... *E. cruzi*

   No pale middorsal stripe (moderate and intermediate elevations of western part of Cordillera Nombre de Dios and west-central Yoro to northwestern Olancho) ... . *E. stadelmani*

5. Upper lip distinctly flared; vocal slits absent in adult males; males 26-30 mm SVL; male tympanum length 72-85 % of eye length (moderate elevations of Sierra de Omoa) ..... *E. omoaensis*

   Upper lip not flared; vocal slits present in adult males; males less than 26 mm SVL; male tympanum length 35-68 % length of eye, or tympanum very indistinct to hidden and unmeasureable 6

6. Modal webbing formula I 2 – 2 4/5 II 2 – 3 3/4 III 3 – 4 1/4 IV 4 1/4 – 2 3/4 V; male tympanic annulus indistinct, very indistinct, or hidden (low and moderate elevations of central and eastern portions of Cordillera Nombre de Dios)..... ..... *E. fecundus*

   Modal webbing formula I – II 2^+ – 3 4/5 III 3^+ – 4 1/2 IV 4 1/2 – 3^- V or I 2^+ – 2 4/5 II 2 – 3 3/4 III 3 – 4 1/2 IV 4 1/2 – 3^- V; male tympanic annulus distinct or indistinct 7

7. Male tympanic annulus distinct or indistinct, that of female very indistinct; male tympanum length 35-46 % length of eye; occurs in forest well away from streams (intermediate elevations of western and central portions of Cordillera Nombre de Dios) ..... *E. saltuarius*

   Male tympanic annulus distinct, that of female indistinct; male tympanum length 47-68 % length of eye; occurs alongside streams (moderate and intermediate elevations of sierras Omoa and Espíritu Santo) ..... *E. milesi*

Source MNHN, Paris

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TITLE PAGE

Any manuscript submitted to *Alytes* should start with a title page, including all relevant general information about the paper: (1) exact title, authorship, address(es) of author(s); (2) address for correspondence regarding this manuscript, number of pages, of plates and of figures. If the paper is published, all information under (1), preceded with the complete bibliographic reference of the paper (*Alytes*, year of publication, volume, issue, pages), will appear on top of its first page, where it can immediately be found by librarians and readers. Information under (2) will be useful to the Editors to process the manuscript.

Running titles and lists of key words need not be provided, as these are not used in *Alytes*.

TITLE

The title should be as short as possible and should describe adequately the contents of the paper. It should be typewritten in lower case, except for initials that must be printed in capitals for grammatical or nomenclatural reasons (see below).

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If a series of papers dealing with the same question is anticipated, rather than use numbers, it is recommended to use titles consisting of two parts separated by a colon: the first part will be common to all papers of the series and the second part (subsidiary title) will be different in each paper. Numbering of the papers of such a series is acceptable in *Alytes* only if the whole series is to be published in this journal.

It is recommended that titles of papers include reference to the taxonomic group(s) studied. As all papers published in *Alytes* concern amphibians, the name Amphibia should be omitted in this taxonomic reference, which should be presented using commas and not colons to separate names of decreasing hierarchical levels: e.g., "(Gymnophiona, Typhlonectidae)", "(Leptodactylidae, Telmatobiinae)", "(Salamandridae, genera *Salamandra* and *Mertensiella*)".

Names of new taxa described in the paper should not be mentioned in the title (see below).

Authorship

Authorship of a manuscript should be restricted to those who actually took part in the work. Honorary authorship is not acceptable. General guidance or direction, sponsorship, technical advice or other forms of assistance can be recognized under *Acknowledgements*. Any multiple-author manuscript submitted should be accompanied by a letter signed by all authors stating that each has read the manuscript and accepts responsibility for the contents.

The title should be followed by the name(s) and address(es) of author(s). In case of multiple authorship, names should be matched to addresses by asterisks: *, **, ***. The entire address should be written in the language of the author's country, except for the name of the country itself, which should be in the language of the paper: e.g., "Spain" in a paper in English, "Espagne" in French, "España" in Spanish. In case a work was carried out in a laboratory different from that of the current address of the author(s), this earlier address should be given in a footnote.

Abstract and summary

Whatever the language used in the paper, the manuscript should start with an English abstract. The abstract should state the major points of the paper as clearly and concisely as possible. It should particularly emphasize new or unusual results or ideas. It should consist of a single paragraph and should not include abbreviations, citations of bibliographic references or of figures and tables in the manuscript.

Names of new taxa described in the paper should not be mentioned in the abstract (see below).

At the end of the paper, a summary should be given in one or several other languages, including either French or Spanish. In papers written in English, this summary may be slightly longer than the English abstract.

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SECTIONS OF THE MANUSCRIPT

The manuscript should preferably be organized according to the following sections: abstract, introduction, material(s) and methods, abbreviations, results, discussion, conclusion, French or Spanish summary, acknowledgements, literature cited, appendices. Sections (as listed above) and possible subsections should not be numbered. The hierarchy of subsections within sections should be limited to a low number of levels, preferably no more than three. Section headings should be centered, whereas those of subsections should be indented. All headings should be typewritten in lower case, except for initials that must be printed in capitals for grammatical or nomenclatural reasons (see below).

ABBREVIATIONS, UNITS AND NUMERALS

Tables 1-3 provide a list of standard abbreviations and symbols that should be used in *Alytes*. Please note that some abbreviations are italicized, while others are not, and that none includes dots. All other abbreviations should follow if possible usual standards in scientific literature, and should be defined in a special section or table of the manuscript. As acknowledged by all major dictionaries (e.g., PROCTER, 1995: 12; THOMPSON, 1995: 13), the term "acronym" designates an abbreviation formed of the initial letters of several words and *pronounced as a word*, such as NATO, AIDS or ISSCA: therefore this term should not be used to designate abbreviations that must be spelled out and cannot be pronounced as a single word, such as most Museum or measurement abbreviations. In such abbreviations, letters should not be separated by dots (e.g., "MNHN", not "M.N.H.N."). Signs, symbols or characters that cannot be typed with the printing equipment used by author(s) should be added by hand on every occurrence in each copy of the manuscript.

In text or in legends, a sentence should never start with an abbreviation.

Weights and measures should follow the International System of Units (SI). Table 4 gives the standard abbreviations for the most common of these units, which should be used in text, tables and figures. Please note that none is italicized and that none includes dots. Unusual units should be defined before their first use. Measurements should be given in figures which are consistent with the degree of accuracy obtainable.

Numbers one to nine should be spelled out, unless they precede units or are part of a series of numbers: e.g., "3 mm", "3 to 4 days", "3-4 days". Numbers of 10 or larger should be given as Arabic numerals except at the beginning of a sentence. Numbers up to four digits should be written in one block: e.g., "1948", "6500". In numbers with five or more digits, a space should be used to separate thousands from hundreds, in order to avoid confusion between the English style on one hand (where comma is used) and the French and Spanish styles on the other (where dot is used): e.g., "35 637", "350 000", "12 000 000". Dates should be given by day, month and year: e.g., "11 February 1960", "11 Feb. 1960" or "11.II.1960". Times of day (24-hour clock) can be written either as "17 h 00" or as "17.00 h" Decimals should not be given naked: e.g., "0.5", not ".5".

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Tab. 1. - Various standard abbreviations and symbols to be used in text, plates and figure legends in *Alytes*.

Abbreviation or symbol	Meaning	Abbreviation or symbol	Meaning
ad	adult	ppm	parts per million
D	Mahalanobis distance	Prof	Professor
df	degrees of freedom	*r*	coefficient of correlation
DNA	desoxyribonucleic acid	RNA	ribonucleic acid
Dr	Doctor	S	south
E	east	*s*	standard deviation
F_1	first generation offspring	s_x	standard error of the mean
H	standard value of Kruskal-Wallis test	SE	southeast
		SEM	scanning electron microscopy
H_0	null hypothesis	SO	sud-ouest
HL	head length[1]	sub	subadult
HW	head width	SVL	snout-vent length
im	imago[2]	SW	southwest
ind	individual	*t*	standard value of Student *t* test
juv	juvenile		
ln	natural logarithm	tad	tadpole
log	base 10 logarithm	TL	tibia length
M	median	*U*	standard value of Mann-Whitney *U* test
max	maximum		
min	minimum	*V*	variation coefficient
n	sample size	W	west
N	population size	$\bar{x}$	mean
N	north	Σ	sum
N°	number	χ^2	standard value of chi-square test
NE	northeast		
NO	nord-ouest	*	significant ($P < 0.05$)
ns	not significant ($P > 0.05$)		
NW	northwest	**	highly significant ($P < 0.01$)
O	ouest		
P	probability of wrongly rejecting the null hypothesis (significance level)	***	very highly significant ($P < 0.001$)
		%	per cent
		‰	per thousand
pH	hydrogen ion activity	♂	male
PhD	Doctor of Philosophy	♀	female

1 Preferably measured on side of head (see e g. LIU, 1950 19)
2 International term for "just metamorphosed amphibian" (see DUBOIS, 1978)

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Tab. 2. - Standard abbreviations for 20 associations, organizations and countries, to be used in text, plates and figure legends in *Alytes*.

Abbreviation	Meaning
AHA	Asociación Herpetológica Argentina
AHE	Asociación Herpetológica Española
ASIH	American Society of Ichthyologists and Herpetologists
BHS	British Herpetological Society
DAPTF	Declining Amphibian Populations Task Force
DGHT	Deutsche Gesellschaft für Herpetologie und Terrarienkunde
EU	European Union
ICZN	International Commission on Zoological Nomenclature
ISSCA	International Society for the Study and Conservation of Amphibians
IUCN	World Conservation Union
NATO	North Atlantic Treaty Organization
ÖGH	Österreichische Gesellschaft für Herpetologie
SEH	Societas Europaea Herpetologica
SHF	Société Herpétologique de France
SSAR	Society for the Study of Amphibians and Reptiles
UK	United Kingdom
UNO	United Nations Organization
USA	United States of America
WCH	World Congress of Herpetology
WWF	World Wide Fund for Nature

CAPITALS

In the headings, subheadings, text, tables, and figure captions, the use of capital letters as initials should be limited to situations where this is strictly compulsory for nomenclatural or grammatical reasons: Latin scientific names above the species level, names of months and days in English (e.g., "September", "Saturday"), names of persons, countries, standard or official geographic names, nouns in titles of books, periodicals, papers or chapters when cited in the text (but not in the list of references: see below), nouns and adjectives in titles of institutions when cited in the text (e.g., "Muséum National d'Histoire Naturelle, Paris"), etc. Descriptive geographic adjectives such as "south", "southern", "central", "lower", etc., should not start with a capital except when they are included in standard or official administrative names of countries or regions: e.g., "New South Wales", "South Africa", "Northern Frontier Province", "Central Province", "Hautes Alpes". Vernacular or common names of taxa (e.g., "anurans", "brown frogs", "ranids"), names of anatomical structures (e.g., "keratodont", "canthus rostralis") or of scientific disciplines (e.g., "zoology", "herpetology", "genetics") should not start with a capital.

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Tab. 3. - Standard abbreviations for 30 herpetological Museum collections, to be used in text, plates and figure legends in *Alytes*.

Abbreviation	Meaning
AMNH	American Museum of Natural History, New York, New York, USA
ANSP	Academy of Natural Sciences, Philadelphia, Pennsylvania, USA
BMNH	Natural History Museum, London, United Kingdom
CAS	California Academy of Sciences, San Francisco, California, USA
CIB	Chengdu Institute of Biology, Academia Sinica, Chengdu, Sichuan, China
CVULA	Colección de Vertebrados de la Universidad de Los Andes, Mérida, Venezuela
FML	Fundación Miguel Lillo, Tucumán, Argentina
FMNH	Field Museum of Natural History, Chicago, Illinois, USA
KU	Museum of Natural History, The University of Kansas, Lawrence, Kansas, USA
LACM	Los Angeles County Museum of Natural History, Los Angeles, California, USA
MACN	Museo Argentino de Ciencias Naturales Bernardino Rivadavia, Buenos Aires, Argentina
MCZ	Museum of Comparative Zoology, Cambridge, Massachusetts, USA
MHNG	Muséum d'Histoire Naturelle, Genève, Switzerland
MNCN	Museo Nacional de Ciencias Naturales, Madrid, Spain
MNHN	Muséum National d'Histoire Naturelle, Paris, France
MNRJ	Museu Nacional do Rio de Janeiro, Rio de Janeiro, Brazil
MSNG	Museo Civico di Storia Naturale Giacomo Doria, Genova, Italy
MVZ	Museum of Vertebrate Zoology, University of California, Berkeley, California, USA
MZUSP	Museu de Zoologia, Universidade de São Paulo, São Paulo, Brazil
NMW	Naturhistorisches Museum, Wien, Austria
RMNH	Rijksmuseum van Natuurlijke Historie, Leiden, Netherlands
ROM	Royal Ontario Museum, Toronto, Canada
SMF	Senckenberg Museum, Frankfurt-am-Main, Germany
UIMNH	Museum of Natural History, University of Illinois, Urbana, Illinois, USA
UMMZ	Museum of Zoology, University of Michigan, Ann Arbor, Michigan, USA
USNM	National Museum of Natural History, Washington, D.C., USA
ZFMK	Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, Germany
ZIL	Zoological Institute, Academy of Sciences, Saint-Petersburg, Russia
ZMB	Zoologisches Museum an der Humboldt-Universität, Berlin, Germany
ZSI	Zoological Survey of India, Calcutta, India

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Tab 4 - Standard abbreviations for measurement units to be used in text, plates and figure legends in *Alytes*

Abbreviation	Meaning	Abbreviation	Meaning
cm	centimetre	mm	millimetre
d	day	mo	month
g	gramme	ms	millisecond (time)
h	hour	My	million years
ha	hectare	n	chromosome number
Hz	hertz	nm	nanometre (10^{-9} m)
J	joule	s	second (time)
kg	kilogramme	V	volt
kHz	kilohertz	W	watt
km	kilometre	y	year
l	litre	µm	micrometre (10^{-6} m)
m	metre	°C	degree Celsius
mg	milligramme	°	degree (angle)
min	minute (time)	'	minute (angle)
ml	millilitre	"	second (angle)

Names of authors of cited literature, as well as names of persons mentioned in the acknowledgements, should be typed in capital letters (preferably small capitals), both in text and in figure and table legends, and in the list of references. On the other hand, authors' names following Latin scientific names, in parentheses if necessary, should be typed in lower-case letters, followed by a comma and the date: e.g., "*Rana temporaria* Linnaeus, 1758"; "*Bufo bufo* (Linnaeus, 1758)". The same rule should be followed for persons' names that are included in standard experimental or statistical equipments, procedures or methods: e.g., "Petri dish", "Ringer solution", "Feulgen reaction", "Lincoln-Petersen index", "Mahalanobis distance", "Mann-Whitney *U* test".

ITALICS

Parts of the text that are meant to be finally printed *in italics* should be typed underlined or printed *in italics*. Italics should be used for scientific names of the genus and species groups, for new or newly defined scientific terms, for some anatomical names (e.g., names of muscles), for titles of books, periodicals, papers or chapters, and for emphasis on particular terms or sentences. They should not be used for Latin or other foreign terms or abbreviations of common use or "that are now considered standard English in science" (HUTH et al., 1994: 170), such as "e.g.", "i.e.", "etc.", "et al.", "s. str.", "a priori", "vice versa", "hoc loco", "in vivo", "canthus rostralis" or "sp. nov.".

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Footnotes

The use of footnotes is not encouraged in *Alytes*. They may however be used to clarify tables, and in the text when this is clearly the best solution to briefly present information that does not belong in the text but is nevertheless useful to the understanding of the latter. Footnotes should be numbered in Arabic numbers (1, 2, 3...) from the beginning to the end of the paper.

Specimens, taxonomic and geographic information

Specimens

Papers based on animals killed for the purpose of research should indicate the exact location and catalogue numbers of voucher specimens and, when appropriate, information on collecting permits and licenses.

Holotypes of newly described taxa, and if possible all other studied specimens, should be deposited in internationally recognized scientific institutions, preferably in Museums, as these institutions have the duty to provide specimens with permanent storage and care, and to make them available for study to the international scientific community. Table 3 provides a list of abbreviations that should be used in *Alytes* to designate some major herpetological Museum collections in the world; abbreviations used for other collections should be defined in the paper (see above).

Taxonomic accounts

To be acceptable in *Alytes*, any paper proposing description of new taxa should include clear evidence that a thorough investigation of related taxa has been carried out.

Species or subspecies taxonomic accounts should be organized following subsections such as: synonymy, holotype, paratypes, type locality, etymology of name, diagnosis, description, variation, measurements, coloration, comparisons, phylogeny, natural history, distribution, comments Genus or subgenus taxonomic accounts should be organized following subsections such as: synonymy, type species (with its mode of designation), etymology of name, species content, diagnosis, variation, comparisons, phylogeny, natural history, distribution, comments. *Mention of type species of genera should always be accompanied by precise information on their mode of designation.*

Synonymies presented, when justified, at the head of taxonomic accounts, should preferably be limited to lists of genuine synonyms (sensu Smith & Smith, 1973) and of new combinations and subsequent spellings. They should preferably not include chresonyms (Smith & Smith, 1973), or, if these are given, they should be presented in such a way as

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to be clearly identified and distinguished from true synonyms, e.g., by use of a colon between the scientific name and the name of the (first) author of reference. The mathematical symbol "=" is not appropriate to designate synonymies and should never be used in this context. Instead, sentences like "*Hyla viridis* Laurenti, 1768 (subjective junior synonym of *Rana arborea* Linnaeus, 1758)" should be used.

Descriptions of specimens should mention their sex and age class (e.g., tadpole, imago, juvenile, subadult, adult). In descriptions, it is strongly recommended to include measurements, at least the four following standard ones: SVL, HW, HL and TL (see tab. 1). Other measurements not mentioned in tab. 1 should be defined in the paper

Descriptions should be written in a homogeneous manner. In a given paper, a choice should be made by the author(s) between telegraphic style ("Head wider than long") or complete sentences with verbs ("The head is wider than long"). If possible, telegraphic style should be chosen. If several taxa are described in the same paper, their descriptions should follow exactly the same format, possibly with numbered subdivisions.

In order to facilitate comparisons between different works, standard descriptive methods, terms, formulae or stage tables, when available, should be used: e.g., DUBOIS's (1978) major developmental stages for amphibians, GOSNER's (1960) developmental table for tadpoles, DUBOIS's (1995) format for the presentation of tadpole keratodont formulae, or MYERS & DUELLMAN's (1982) format for the presentation of webbing formulae.

NOMENCLATURE

For all nomenclatural matters, the rules of the most recent edition of the *International Code of Zoological Nomenclature* (ANONYMOUS, 1985; cited below as "the *Code*") should be strictly followed Particular attention will be paid by the Editors to the fact that scientific names used in papers published in *Alytes* are the valid ones according to the *Code*, even if they are not the "usual" ones. In particular, family-group names, as well as species-group and genus-group names, should follow the Rule of Priority, except for specific rulings by the International Commission on Zoological Nomenclature.

The inclusion of the author's name in citing the name of a taxon is primarily intended for the purpose of helping the search for literature and information: "It is not, as many detractors would have it, merely to promote the reputation of a scientist or simply an egotistical exercise. The value of knowing the author's name so as to be able to track down the original reference (...) is much more important than merely knowing who the person responsible for the name is. There is, as yet, no other effective way to keep track of authors, publication dates and to trace the original references." (NG, 1994: 509). With the help of the *Zoological Record*, knowledge of the author's name and of the date is usually sufficient to find the reference of the original description of a taxon. However such a search is much more difficult when only the author's name, but not the date, is given. Therefore, in all parts of manuscripts submitted to *Alytes*, scientific names of taxa should be mentioned either followed by their complete authorship information, i.e. their complete (not abbreviated) author's name *and their date* (either in parentheses or not, according to the *Code*), or without both, but never with the author's name without the date: e.g., "*Rana*

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catesbeiana Shaw, 1802" or "*Rana catesbeiana*", not "*Rana catesbeiana* Shaw"; "*Hyla arborea* (Linnaeus, 1758)" or "*Hyla arborea*", not "*Hyla arborea* (L.)"; "*Eleutherodactylus* Duméril & Bibron, 1841" or "*Eleutherodactylus*", not "*Eleutherodactylus* D. B."; "Ranidae Rafinesque-Schmaltz, 1814" or "Ranidae", not "Ranidae Rafinesque".

The Latin name of any species-group taxon or of any new combination should be written in full at least once, on the occasion of its first occurrence in the paper. If subsequently the same taxon is mentioned a high number of times, the generic name should be replaced by its initial; the same rule may apply to the specific name of subspecies. Such a use of shortened names is not necessary in papers where scientific names are mentioned only a small number of times.

When proposing new scientific names, author(s) should pay close attention to checking that these names are not preoccupied. New names should be formed according to the rules and recommendations of the *Code*, and should, as far as possible, be simple, short and euphonious. Authors are encouraged to use their imagination to propose new, original names, rather than always using common epithets which have already been applied to many animal species (e.g., "*viridis*", "*rugosus*", "*major*", "*vulgaris*", "*montanus*", "*occidentalis*", "*sinensis*"). For species-group names based on geographic terms, attention of authors is drawn to the possibility to use local names in any language placed in apposition to the generic name, which is often shorter, more euphonious and more original than constant use of the suffixes "*-ensis*" or "*-icus*": e.g., "*Rana diuata* Brown & Alcala, 1977"; "*Ranixalus gundia* Dubois, 1986"; "*Aubria masako* Ohler & Kazadi, 1990".

The name of a new taxon described in the paper should not appear before the heading of the section devoted to the description of the taxon, so that there can be no doubt or disagreement among subsequent authors as to the page to be cited as first page of appearance of the new name.

Geographic information

Both in the paper and in the addresses of authors in the title page, geographic names of countries should be given in the language of the paper: e.g., "Germany" in a paper in English, "Allemagne" in French, "Alemania" in Spanish, never "Deutschland". The same is true for international geographic units, such as seas, lakes, rivers, mountains: e.g., in a paper in English, "Amazon Basin", "Indian Ocean", "Rhine", "Alps". In contrast, names of provinces, districts, towns, rivers, lakes, mountains, etc., entirely included within a country, should be given in the (or one of the) official language(s) of this country, not in the language of the paper: e.g., "Wien", not "Vienna"; "Massif Central", not "Central Massif"; "Castilla", not "Castile". However, generic geographic terms such as "mountain", "river", "lake", should be given in the language of the paper: e.g., in a paper in English, "Borjomi canyon", "lake Dreibrüdersee", "Samothraki island", "Thévenon pond", "Masako forest". *Special care should be taken to ensure that geographic words are correctly spelled in their original languages, including accents (e.g., "é", "ì", "à", "ê") and other diacritic marks such as tilde ("ñ"), diaeresis ("ü") or cedilla ("ç").*

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Localities of study and/or collection of specimens should be referred to as precisely as possible, preferably giving their latitude and longitude (in relation to Greenwich meridian) and their altitude above sea level (in metres). Distances should be given in metres or kilometres: e.g., "Masako forest, near Batibongena village, 15 km from centre of Kisangani on the ancient road to Buta, Zaire". As different atlases and maps often give slightly different latitudes, longitudes or altitudes for the same locality, it is recommended to provide, in the *Literature Cited*, references of the documents used to find the coordinates of localities given in the paper. If altitude and/or position was/were determined directly in the field, e.g. by use of an altimeter or a Global Positioning System (GPS), rather than on a map, this should be stated in the *Material(s) and Methods* section of the paper.

FIGURES, TABLES AND APPENDICES

FIGURES

Alytes encourages the publication of high quality figures (photographs, drawings, graphs, etc.) illustrating the major points of a paper. A good figure may often be more informative and convincing than long descriptions or discussions. To be acceptable in *Alytes*, figures should be of good quality and should clearly show the character to be depicted or the results of experimental work to be illustrated.

Each figure ("figure" in English and French; "figura" in Spanish) should be planned to accommodate reduction and to occupy, *together with its legend*, no more than the maximum height and width of the printed portion of a page in *Alytes* (13 × 18.5 cm). Originals of figures submitted should not exceed 21 × 29.7 cm. The size of the lettering should ensure its legibility after reduction. Optimum reproduction is achieved by reducing slightly the size of the figures during the process of publication.

Figures should include a scale of magnification, dimension or distance where appropriate. This should appear as a scale bar on the figure itself, not only in the legend. All axes of graphs should be labelled. If letters or numbers are used in the figure, these should not be handwritten, but printed or transferred. Abbreviations in figures should follow the conventions given above and should be defined either in the text or in the figure legend.

Several figures or subfigures can be labelled and mounted on Bristol board to produce a single plate that will occupy, with its legend, a full page of the journal. Subfigures of a composite figure should be lettered in lower case (a, b, c...). It is suggested to protect figures, in particular photographs mounted as plates, by a transparent overlay, e.g., tracing paper; any areas of particular interest or importance on a photograph may be outlined in pencil on the overlay for the guidance of the printer.

Figure legends should be intelligible without reference to the text. Legends of figures showing specimens or parts of specimens should include information about the actual

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specimen shown (collection number of specimen, date of collecting or of photograph, etc.). Legends of figures should not appear on the figures themselves. They should be grouped and presented double-spaced on separate sheet(s).

Figures should be numbered in Arabic numerals in the order of their first mention in the text. In the text, figures should be referred to in an abbreviated form (e.g., "fig. 2"), except at the beginning of a sentence in English (e.g., "Figure 4 shows..."). Several figures should be cited using "fig.", not "figs.": e.g., "fig. 4-5". If several figures or subfigures are assembled on a plate (see above), they will always be referred to by their individual numbers (e.g., "fig. 3", "fig. 7a"; not "pl. III, fig. 3"), and plates will not be numbered as such (in *Alytes*, pages occupied by plates are numbered just like standard pages of the journal).

The top, bottom or back of each figure or plate should be labelled in pencil with the (first) author's name, the figure number and its date of submission.

Tables

Alytes encourages the publication of complete tables of original data, that can be used by subsequent authors for further analysis or critical reevaluation, rather than simply providing results of statistical tests, phylogenetic analyses, etc.

Tables should be as clear and simple as possible, and should avoid the unnecessary multiplication of columns and lines. During the preparation of tables in text processing, tabulations, rather than simple spaces, should be used to separate columns.

Each table ("table" in English; "tableau" in French; "tabla" in Spanish) should be typed or printed, double-spaced, on a separate sheet, together with its legend. Table legends should be intelligible without reference to the text. Abbreviations in tables should follow the conventions given above and should be defined in the text or in the table legend.

Tables should be numbered in Arabic numerals in the order of their first citation in the text In the text, tables should be referred to in an abbreviated form (e g., "tab. 2"), except at the beginning of a sentence in English (e.g., "Table 4 shows..."). Several tables should be cited using "tab.", not "tabs.": e.g., "tab. 4-5".

Appendices

As far as possible, contributors should avoid the use of appendices in manuscripts submitted to *Alytes*. In many cases, data that are sometimes provided in appendices can be presented as in-text tables. Only very long tables (more than two pages, e.g. giving details of original data), or very specific discussions of technical or other questions that would unnecessarily make the text unwieldy, should be placed in an appendix ("appendix" in English; "appendice" in French; "apéndice" in Spanish).

Appendices should be labelled in Arabic numbers in the order of their first citation in text In the text, appendices should be referred to in an abbreviated form (e.g., "app.

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2" in English and French; "ap. 2" in Spanish), except at the beginning of a sentence in English (e.g , "Appendix 4 shows..."). Several appendices should be cited using "app ", not "apps.": e.g., "app. 4-5".

BIBLIOGRAPHIC REFERENCES

Authors are particularly urged to ensure that bibliographical details are accurate. *Correct references are the responsibility of the author(s)* This implies that, as far as possible, all cited references should have been checked personally by the author(s), not copied from other sources. When this is impossible, the reference should be followed by the mention "[Not seen]", possibly followed by reference to the source used (see example below).

CITATION IN TEXT

In the text (including synonymies of systematic accounts, figure legends and tables), bibliographic references should be referred to by the name of the author(s), written in capital letters, followed by the *actual* date of publication of the work: e g., "GÜNTHER, 1859"; "GRAF & POLLS PELAZ, 1989"; "INGER et al , 1984*b*"; "ANONYMOUS, 1993". References such as "GÜNTHER, '1858' (1859)" should not be used: if the date that is printed in the publication itself is not the actual date of publication, this should simply appear in the full reference given in the list of references (see below). Papers with two authors should be referred to in the text by their names, connected by the ampersand (sign "&", international for "and", "et", "y", "und", etc.). Papers with more than two authors should always be referred to by the first author's surname followed by "et al.". Strings of cited references dealing with the same question should be given *in chronological order of publication*, and not in alphabetical order of first authors. *Special care should be taken to ensure that all references mentioned in the text are included in the list of references, and vice versa.* Dates should match.

Two or more references by the same author(s), or having the same first author in case of more than two authors, and published in the same year, should be distinguished by adding, after the date, lower case, italicized letters (*a*, *b*, *c*...); if possible, these letters should be given in chronological order of publication These lower case letters may be either connected by a hyphen (which points to all references from first to last including those not listed between them) or separated by commas (which points to those references only): e g., "DUMÉRIL et al., 1854*a-c*" points to references appearing in the list of references under the letters *a*, *b* and *c*, while "DUMÉRIL et al., 1854*a*,*c*" points only to references appearing in the list of references under the letters *a* and *c*.

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LIST OF REFERENCES

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DETAILED FORMAT, CONVENTIONS AND ABBREVIATIONS

Only publications with a finite number of identified authors should be cited under their names. Other publications, even if published under the name, acronym or abbreviation of a committee, an institute or any other collective body, should be cited, both in the text and in the references, as "ANONYMOUS" (see examples above and below). Except when the contrary is expressly required by their language, authors' surnames with a separated prefix (e.g., "DE", "LE", "VAN") should be cited, both in the text and in the references, with the prefix preceding the name (see example above).

Special care should be taken to ensure that all names and words in references are correctly spelled in their original languages, including accents (e.g., "è", "ì", "à", "ê") and other diacritic marks such as tilde ("ñ"), diaeresis ("ü") or cedilla ("ç"). Titles of papers and books should be quoted exactly, even when they contain mistakes: in such cases, the mention "[sic]" may be added after the identified mistake (see example above)

Dates given for references should be the actual date of publication, i.e. *of public distribution*, not of writing or printing, of the book or periodical. This is of particular importance for publications containing new scientific names or nomenclatural acts. Actual publication dates may be ascertained using various kinds of evidence, including specialized publications, and this may be indicated at the end of the reference (see examples above and below)

When several editions of a book have been published, the reference should indicate which one was used by the author(s) of the manuscript. For books, reports and theses, city of publication should precede the name of publisher and *complete pagination should be*

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given, including possible additional unnumbered pages at the beginning or end of the volume, which should be written in small Roman numbers and between square brackets: e.g., "[i-xix]". In-text figures and plates included in the book pagination should not be mentioned. Plates having their own numbers should be cited using Arabic numbers (e.g., "pl. 1-88"), even when in fact they bear Roman numbers (e.g., "pl. I-LXXXVIII") in the actual publication. Table 5 provides standard abbreviations that should be used in references for terms like "fascicule", "figure", or "plate" Please note that they are not italicized, that they end with a dot, and that plural should not be indicated (e g. by adding an "s" at their end or by doubling the abbreviation, e.g. "pp.").

Titles of periodicals composed of one single word or two words linked by a hyphen should be given in full: e.g., "*Herpetologica*", "*Amphibia-Reptilia*". Abbreviations can be used for titles of periodicals composed of several separated words. In order to avoid having several distinct abbreviations for the same term (e.g., "*herp.*", "*herpet.*" or "*herpetol.*" for "*herpetological*"), a list of common abbreviations that should be used for terms in titles of periodicals is provided in tab. 5. Please note that all are italicized and end with a dot. These abbreviations should not be used for other terms than those given in tab. 5. Other, less usual, abbreviations, should be clear, self-evident and non-ambiguous; in case of doubt or of possible confusion, words should not be abbreviated. Except those in tab. 5, very short terms should be given in full: e.g., "*Acta*", "*New*". Names of cities should not be abbreviated: e.g , "*London*", "*San Francisco*". In titles of periodicals including several words, nouns (or their abbreviations) should start with a capital letter, and adjectives (or their abbreviations) with a lower case letter, except for first word of title (e.g , "*Occ. Pap. Mus. nat. Hist. Univ. Kansas*"). Number of volume should always be given as a bold Arabic number (e.g., "**88**"), even when in fact it appears as a Roman number (e.g. "LXXXVIII") in the actual publication. For a given periodical, series, volume, section, and number, should be referred to respectively in parentheses followed by a comma, in bold followed by a space, in parentheses followed by a space, and in parentheses followed by a colon: e.g., "(2), **14** (B) (3):".

Works referred to in the *Literature Cited* should be either published or accepted for publication in an identified journal: in the latter case, they should be cited as "in press" both in the text and in the list of references. Papers either "in preparation" or "submitted" (but not yet accepted) should not appear in the *Literature Cited*: the corresponding work may be mentioned, if this is necessary, in the text as "unpublished" or "in preparation". These terms should not be abbreviated, nor should phrases like "personal communication", "unpublished results/data", or other undefined terms. Personal observations or papers by other authors which have not yet appeared in print may be cited only when written authorization from the communicator is submitted with the manuscript.

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Tab 5 - Standard abbreviations to be used in lists of references in *Alytes*. Most of these abbreviations can be used both for a noun (starting with a capital letter) and for an adjective (starting with a lower-case letter, except if first term of title). Besides, most of them can correspond to slightly different words according to the language of the publication and the word being in the masculine or feminine, in the singular or plural e.g., "Herp." can mean "Herpetology", "Herpétologie", "Herpetología", etc.; "herp." can mean "herpetological", "herpetologique", "herpétologiques", "herpetológico", "herpetológica", "herpetológicos", "herpetológicas", etc. In the table below, only one spelling is given (usually the English noun) as an example. Proper terms can easily be deduced from the context (language of the publication, place in a series of abbreviations). Some of these abbreviations can be combined with other terms to produce longer abbreviations: e.g., "Biochem." for "Biochemistry", "Hydrobiol." for "Hydrobiology", "Naturwiss." for "Naturwissenschaft", "neotrop." for "neotropical", "southwest." for "southwestern"

Abbreviation	Meaning	Abbreviation	Meaning
ap.	apéndice(s)	*Bras. / bras.*	*Brasil*
app.	appendix/ce(s)	*brit.*	*british*
ed.	editor(s)	*Bull.*	*Bulletin*
fasc.	fascicule(s)	*C. r.*	*Compte rendu*
fig.	figure(s)	*Cah.*	*Cahier*
lám.	lámina(s)	*Cal. / cal.*	*California*
n.s.	new series	*Can. / can.*	*Canada*
p.	page(s)	*caribb.*	*caribbean*
pl.	plate(s)	*Cat.*	*Catalogue*
réd.	rédacteur(s)	*cent.*	*central*
ser.	series	*Chem. / chem.*	*Chemistry*
suppl.	supplement(s)	*Ci.*	*Ciencia*
tab.	table(s)	*Co.*	*County*
vol.	volume(s)	*Col.*	*Coleoptera*
		Coll.	*Collection*
Abh.	*Abhandlung*	*comp.*	*comparative*
Abst.	*Abstract*	*Conserv.*	*Conservation*
Acad. / acad.	*Academy*	*Contr.*	*Contribution*
Afr. / afr.	*Africa*	*Crust.*	*Crustacea*
Akad.	*Akademie*	*Cuad.*	*Cuaderno*
Am. / am.	*America*	*Cyt. / cyt.*	*Cytology*
An.	*Anales*	*Dep.*	*Department*
Anat. / anat.	*Anatomy*	*Dev. / dev.*	*Development*
Anim. / anim.	*Animal*	*Dip.*	*Diptera*
Ann.	*Annals*	*Diss.*	*Dissertation*
Anz.	*Anzeiger*	*Dtsch. / dtsch.*	*Deutschland*
appl.	*applied*	*east.*	*eastern*
Ara.	*Arachnid*	*Ecol. / ecol.*	*Ecology*
Arch.	*Archive*	*Embr. / embr.*	*Embryology*
Arg. / arg.	*Argentina*	*Endocr. / endocr.*	*Endocrinology*
Arth.	*Arthropode*	*Ent. / ent.*	*Entomology*
As. / as.	*Asia*	*Entw.*	*Entwicklung*
Asoc.	*Asociación*	*Env. / env.*	*Environment*
Ass.	*Association*	*Esp. / esp.*	*España*
Aust. / aust.	*Australia*	*Evol. / evol.*	*Evolution*
Behav. / behav.	*Behaviour*	*exp.*	*experimental*
Beitr.	*Beitrag*	*Fac.*	*Faculté*
Belg. / belg.	*Belgique*	*Forsch.*	*Forschung*
Ber.	*Bericht*	*Fortschr.*	*Fortschritt*
Biol. / biol.	*Biology*	*Fr. / fr.*	*France*
Bol.	*Boletin*	*gen.*	*general*
Boll.	*Bolletino*	*Genet. / genet.*	*Genetics*
Bot. / bot.	*Botany*	*Geogr. / geogr.*	*Geography*

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Abbreviation	Meaning	Abbreviation	Meaning
Geol. / geol.	*Geology*	*occid.*	*occidental*
Ges.	*Gesellschaft*	*Ois.*	*Oiseau*
Gesch.	*Geschichte*	*Ökol. / ökol.*	*Ökologie*
Giorn.	*Giornale*	*ori.*	*oriental*
hebd.	*hebdomadaire*	*Orn. / orn.*	*Ornithology*
Helm. / helm.	*Helminthology*	*Orth.*	*Orthoptera*
Hem.	*Hemiptera*	*Ost. / ost.*	*Osteology*
Herp. / herp.	*Herpetology*	*Öst. / öst.*	*Österreich*
Hist. / hist.	*History*	*Pap.*	*Paper*
Histol. / histol.	*Histology*	*Paras. / paras.*	*Parasitology*
Hym.	*Hymenoptera*	*Path. / path.*	*Pathology*
Ich. / ich.	*Ichtyology*	*Per.*	*Periodical*
imp.	*imperial*	*Phil. / phil.*	*Philosophy*
Ind. / ind.	*India*	*philom.*	*philomatique*
Inf.	*Information*	*Phys. / phys.*	*Physics*
Ins.	*Insecta*	*Physiol. / physiol.*	*Physiology*
Inst.	*Institut*	*Pol.*	*Poland*
int.	*international*	*Pop. / pop.*	*Population*
It. / it.	*Italia*	*preuss*	*preussich*
J.	*Journal*	*Proc.*	*Proceedings*
Jap. / jap.	*Japan*	*Prot. / prot*	*Protistology*
Jb.	*Jahrbuch*	*Prov. / prov*	*Province*
kais.	*kaiserlich*	*Psych. / psych.*	*Psychology*
königl.	*königlich*	*Publ.*	*Publication*
Lab	*Laboratory*	*q*	*quarterly*
Lep.	*Lepidoptera*	*Qld.*	*Queensland*
Limn. / limn.	*Limnology*	*r*	*royal*
linn.	*linnaean*	*Rec.*	*Record*
Mag.	*Magazine*	*reg*	*regionale*
Mal.	*Malacology*	*Rep.*	*Report*
Mamm.	*Mammalogy*	*Repr. / repr.*	*Reproduction*
Math. / math.	*Mathematics*	*Res.*	*Research*
Med. / med.	*Medicine*	*Rev.*	*Review*
Meded.	*Mededelingen*	*Riv.*	*Rivista*
Mem.	*Memoirs*	*Sber.*	*Sitzungsbericht*
mens.	*mensuel*	*Sci. / sci.*	*Science*
Micr. / micr.	*Microscopy*	*Serv.*	*Service*
Midl.	*Midlands*	*sin.*	*sinica*
misc.	*miscellaneous*	*Soc.*	*Society*
Mitt.	*Mitteilungen*	*south.*	*southern*
Moll.	*Mollusca*	*spec.*	*special*
Mon.	*Monograph*	*St.*	*Storia*
Monatsb.	*Monatsberichte*	*Stud.*	*Study*
Monit.	*Monitore*	*Symp.*	*Symposium*
Morph. / morph.	*Morphology*	*Syst. / syst.*	*Systematics*
Mus.	*Museum*	*Tech. / tech.*	*Technique*
Myol. / myol.	*Myology*	*Technol. / technol.*	*Technology*
Myr.	*Myriapoda*	*theor.*	*theoretical*
nac.	*nacional*	*Trans.*	*Transactions*
Nat. / nat.	*Nature*	*Trav.*	*Travaux*
natn.	*national*	*trop.*	*tropical*
Natur.	*Naturalist*	*Univ.*	*University*
Naturf.	*Naturforscher*	*Ver.*	*Verein*
Neth.	*Netherlands*	*Verh.*	*Verhandlung*
north.	*northern*	*west.*	*western*
Novit.	*Novitates*	*Wiss. / wiss.*	*Wissenschaft*
Nutr. / nutr.	*Nutrition*	*Z.*	*Zeitschrift*
occ.	*occasional*	*Zool. / zool.*	*Zoology*

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AUTHOR CHECKLIST

The present *Instructions to Authors* are meant to help authors to prepare manuscripts for *Alytes*, and Editors and referees to review them. They should ensure that manuscripts received are in the good format, make for more rapid processing, acceptance and publication of papers, and contribute to a final high quality journal. For additional help, tab. 6 presents an *Author Checklist* which summarizes 50 major points that should be checked by author(s) before submitting a manuscript to *Alytes*. It is recommended to make a photocopy of this checklist, to mark it with crosses and to send it with the manuscript to the Editors. The same should be done when dispatching the final manuscript to the Chief Editor at the end of the review process. All items of the checklist should be marked with a cross in the column "Yes" after checking, except those which should be marked as "Irrelevant" for a given manuscript: e.g., items (26)-(29) are not relevant for a paper including no description of a new taxon, or items (40)-(46) are not relevant for a paper including no figure.

ACKNOWLEDGEMENTS

The editorial rules presented above are the result of a continuous evolution through a fifteen-year experience (1982-1996) of publication of *Alytes*, but no doubt they will keep on improving in the future: constructive suggestions in this respect will be welcome. Establishment of these standards has greatly benefited from the work of all the colleagues who served as Editors and Corresponding

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Tab 6 - Author checklist: major points that should be checked by any author(s) before submitting a manuscript to *Alytes*. Irr.: irrelevant

Item	Yes	Irr.
(1) The manuscript submitted deals with amphibians as such and brings original information concerning these animals.		
(2) This manuscript has not been published previously and is not under consideration for publication elsewhere.		
(3) Observation or experimental intervention on animals, their capture or killing, were strictly justified for the purpose of advancing scientific knowledge and were made according to ethics of respect for all living beings.		
(4) Information on collecting permits and licenses for the specimens used in the study is provided in the manuscript.		
(5) All pages of the manuscript are numbered, dated, and marked with the (first) author's name.		
(6) All authors have signed letter accompanying manuscript.		
(7) Written authorization from communicators for citing personal observations or unpublished manuscripts is provided.		
(8) Title page includes title, authorship, address(es) of author(s), address for correspondence, number of pages, of plates and of figures.		
(9) The title follows the format of *Alytes*		
(10) The manuscript starts with an English abstract (a single paragraph) and ends with a summary in one or several other languages, including either *French* or *Spanish* [please circle language chosen]		
(11) If the paper is written in English, consistent use of either the *British* or the *American* standard [please circle standard chosen] has been checked throughout the manuscript.		
(12) The text of the manuscript is not justified and words are not divided at the right margin.		
(13) Sections and subsections of the manuscript follow the format of *Alytes*		
(14) References in text and in list of references have been checked to correspond exactly		
(15) All references cited have been checked with the original publications, in case some have not been seen by author(s), this is stated in the list of references.		
(16) Dates given for references, especially those of nomenclatural importance, are their actual publication dates.		
(17) Presentation of references in text and in *Literature Cited* follows the format of *Alytes*		
(18) In text, tables, figure legends and list of references, all names and words are correctly spelled in their original languages, including accents and other diacritic marks.		
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(21) Signs, symbols or characters that cannot be typed with the printing equipment used by author(s) have been added by hand on every occurrence in each copy of the manuscript		
(22) The zoological nomenclature used in the paper strictly follows the *International Code of Zoological Nomenclature*		

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Item	Yes	Irr.
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(24) Use of parentheses for inclusion of author's names and dates of names of taxa is made according to the *Code*.		
(25) All scientific names of taxa, including new combinations, are written in full at least once, on the occasion of their first occurrence in the paper.		
(26) If the paper proposes the description of new taxa, it provides clear evidence that a thorough investigation of related taxa has been carried out.		
(27) New scientific names have been thoroughly checked not to be preoccupied.		
(28) The name of any new taxon described in the paper does not appear, either in the text, or in tables and figure legends, before the heading of the section devoted to the description of the taxon.		
(29) Holotypes of new species-group taxa have been deposited in a permanent and internationally recognized scientific institution.		
(30) The exact location and catalogue numbers of specimens mentioned in the paper are given.		
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(32) Synonymies provided in taxonomic accounts follow the format of *Alytes*.		
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(34) Geographic information is provided following the format of *Alytes*.		
(35) Each table is presented on a separate sheet, with legend above.		
(36) If the manuscript was prepared in text processing, columns in tables are separated by tabulations, not by simple spaces.		
(37) Figures and tables are numbered in Arabic numerals in the order of their first mention in text.		
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